

[H.A.S.C. No. 115-6]

**MILITARY SERVICES FIFTH-GENERATION
TACTICAL AIRCRAFT CHALLENGES
AND F-35 JOINT STRIKE FIGHTER
PROGRAM UPDATE**

HEARING

BEFORE THE

SUBCOMMITTEE ON TACTICAL
AIR AND LAND FORCES

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTEENTH CONGRESS

FIRST SESSION

HEARING HELD
FEBRUARY 16, 2017



U.S. GOVERNMENT PUBLISHING OFFICE

24-678

WASHINGTON : 2017

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CONTENTS

	Page
STATEMENTS PRESENTED BY MEMBERS OF CONGRESS	
Tsongas, Hon. Niki, a Representative from Massachusetts, Ranking Member, Subcommittee on Tactical Air and Land Forces	4
Turner, Hon. Michael R., a Representative from Ohio, Chairman, Subcommittee on Tactical Air and Land Forces	2
WITNESSES	
Bogdan, Lt Gen Christopher C., USAF, Program Executive Officer, F-35 Joint Program Office	4
Davis, LtGen Jon M., USMC, Deputy Commandant for Aviation, Headquarters, U.S. Marine Corps	7
Harris, Lt Gen (Select) Jerry D., USAF, Deputy Chief of Staff for Plans, Programs, and Requirements, Headquarters, U.S. Air Force	10
Miller, RADM DeWolfe, USN, Director, Air Warfare (OPNAV N98), Headquarters, U.S. Navy	9
APPENDIX	
PREPARED STATEMENTS:	
Bogdan, Lt Gen Christopher C.	44
Davis, LtGen Jon M.	75
Harris, Lt Gen (Select) Jerry D.	91
Miller, RADM DeWolfe	83
Turner, Hon. Michael R.	41
DOCUMENTS SUBMITTED FOR THE RECORD:	
[There were no Documents submitted.]	
WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING:	
[There were no Questions submitted during the hearing.]	
QUESTIONS SUBMITTED BY MEMBERS POST HEARING:	
Mr. Bacon	112
Mr. Lamborn	114
Mr. Langevin	111
Mr. LoBiondo	111
Mr. Turner	105

**MILITARY SERVICES FIFTH-GENERATION TACTICAL
AIRCRAFT CHALLENGES AND F-35 JOINT STRIKE
FIGHTER PROGRAM UPDATE**

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES,
Washington, DC, Thursday, February 16, 2017.

The subcommittee met, pursuant to call, at 9:05 a.m., in room 2118, Rayburn House Office Building, Hon. Michael R. Turner (chairman of the subcommittee) presiding.

Mr. TURNER. The hearing will come to order.

The subcommittee meets today to receive testimony on the military services fifth-generation tactical aircraft challenges and to receive an update on the F-35 Joint Strike Fighter [JSF] Program.

I want to welcome our distinguished witness panel for today: Lieutenant General Chris Bogdan, United States Air Force, F-35 Program Executive Officer; Lieutenant General Jon M. Davis, United States Marine Corps, Deputy Commandant for Aviation; Rear Admiral DeWolfe "Chip" Miller, United States Navy, Navy Director of Air Warfare; and Lieutenant General (Select) General Jerry D. Harris, United States Air Force, Deputy Chief of Staff for Plans, Programs, and Requirements.

Gentlemen, we thank you for your service and we look forward to your important testimony today.

Before we begin, we would like to take care of some administrative details. I am pleased to announce that Paul Cook will again be serving as the vice chairman of this subcommittee.

Paul, thank you for agreeing to be vice chairman.

Mr. COOK. Thank you.

Mr. TURNER. I now will turn to introducing the new members who are on the subcommittee. Our new members include Don Bacon, who represents Nebraska's Second Congressional District. A retired Air Force brigadier general, Don has commanded twice at the wing level, at Offutt Air Force Base and Ramstein, Germany.

Matt Gaetz represents Florida's First District, home of one of the largest military districts in the country, including Naval Air Station Pensacola and Eglin Air Force Base.

Trent Kelly represents Mississippi's First District. A colonel in the Mississippi Army National Guard, he has served for 30 years as an engineer, including multiple tours in Iraq.

We also have Jim Banks, who represents Indiana's Third District, home of 122nd Fighter Wing of Indiana National Guard. A Navy supply officer, he has recently completed a tour in Afghanistan.

We are glad to have our new members of the subcommittee and I will now turn to our ranking member, Ms. Tsongas, who will also introduce the new members who are our Democrats.

Ms. TSONGAS. Thank you, Mr. Turner, and I look forward to working with you. And welcome those who are here today to testify.

I would like to recognize our new members to the subcommittee. First, I would like to welcome my colleagues Jim Langevin of Rhode Island and Jim Cooper of Tennessee, who are by no means new to HASC [House Armed Services Committee]. Both Mr. Langevin and Mr. Cooper are ranking members; Mr. Langevin on Emerging Threats and Capabilities, Mr. Cooper on Strategic Forces Subcommittees. Mr. Cooper actually also served on this subcommittee as recently as the 113th Congress, and we are lucky to have him back.

I would also like to recognize additional new members at the subcommittee who are also new to Congress. Congresswoman Jackie Rosen of Nevada's Third Congressional District most recently served as a president of the largest reform synagogue in southern Nevada. Her district is just a short drive from Nellis Air Force Base and home to the U.S. Air Force Warfare Center.

Congressman Salud Carbajal represents the 24th Congressional District of California which is home to a number of military facilities, including Vandenberg Air Force Base. Congressman Carbajal served 8 years in the United States Marine Corps Reserve, including active duty service during the 1991 Gulf war.

Congressman Anthony Brown represents Maryland's Fourth Congressional District and previously served as Maryland's Lieutenant Governor and Majority Whip in the House of Delegates. Congressman Brown was awarded the Legion of Merit for his 30 years of distinguished military service and the Bronze Star for his service in Iraq.

Congressman Tom O'Halleran served for 8 years in the Arizona State legislature before coming to Congress. Prior to his time as an elected official, Tom served on the Chicago Board of Trade and was a small-business owner.

And Congressman Tom Suozzi represents the north shore of Long Island, as well as northwestern Queens. Previously he served as mayor of his hometown, Glen Cove, New York, and was a county executive of Nassau County.

Again, thank you and we welcome them all, not all here today, but I am sure will be participating on a regular basis.

OPENING STATEMENT OF HON. MICHAEL R. TURNER, A REPRESENTATIVE FROM OHIO, CHAIRMAN, SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

Mr. TURNER. Thank you, Ms. Tsongas. I want to thank you again for your commitment to the bipartisan spirit of this subcommittee, which I know we will see in our new members also as a result of your leadership and our relationship.

This is a timely hearing and it is complementary to our Chairman Mac Thornberry's full committee hearing on the state of the military. Last week, the committee heard testimony from each of

the military services' vice chiefs of staff that the force is strained and that the services have to do more with less.

These challenges combined with years of budget-driven national security strategies and cuts, rather than threat-based strategies, have led to a military readiness crisis. With a new administration indicating its intent to rebuild the U.S. Armed Forces, I look forward to working with them to reverse this harmful trend in military readiness. Modernization and building capacity are critical components of restoring readiness.

This brings us to today's focus, fifth-generation tactical fighter requirements and the F-35 strike fighter program. This is the third oversight hearing the committee has held over the past year on the requirements and the importance of the fifth-generation fighters, given current and emerging threats. And this is a critical time for the F-35.

One of these hearings was at the National Museum of the United States Air Force at Wright-Patterson Air Force Base on June 18th, 2016, and the witness then, Major General Jerry Harris, here with us today, and then Vice Commander of Air Combat Command, showed us a striking picture of one-half of an F-35 strike fighter and one-half of a Chinese J-31 fighter joined together.

It looked like one aircraft and it left no one to doubt that our adversaries are extremely close to fielding fifth-generation fighter programs of their own. With only 187 F-22s and 219 F-35s being produced, we will have very limited fifth-generation capacity. The F-35 strike fighter program is nearing the end of its development program and is over 90 percent complete. It is no secret that the F-35 development program has faced some significant challenges in cost and schedule overruns early in development. After being re-baselined in 2010, the program has been successful in meeting cost and schedule goals.

Although F-35 development is scheduled to be completed by October of this year, General Bogdan has noted in previous updates that there remains about 3 to 4 months of schedule risk to completion of the F-35 development program and additional costs could be incurred.

In terms of oversight, the subcommittee remains concerned about the costs associated with closing out the F-35 development program, the maturity of the program to potentially execute a block buy for fiscal years 2018 through 2020, and determining whether more efficient program management can help accelerate the initial operational test and evaluation program. We expect to gain a better understanding of these important oversight issues today.

During our hearing last July, on fifth-generation fighters, General Herbert "Hawk" Carlisle stressed that fourth-generation aircraft still plays a significant role in the near term in assessing fighter capability and inventory concerns, as we have few operational fifth-generation fighters. He also noted that the importance of fifth-generation fighters, and I am going to quote him, says, "The role of our fourth-generation fighters will diminish over time due to two main reasons. The first is they will age out and be replaced by more capable F-35s. But more pressingly, our fourth-generation fighters are more increasingly unable to operate in highly contested

environments where advanced air defense systems render them ineffective.”

Given current fiscal constraints, the military services are being forced to prioritize between building capacity in fourth-generation tactical aircraft inventory to help mitigate some of the immediate readiness burdens on the current force, or trying to accelerate needed fifth-generation tactical aircraft capability.

For national security purposes, it is not a question of one or the other, which I hope we will discuss today. It really is an answer of we need both and we need more of both.

In closing, there have been several reports and comments in regards the President’s concern for the need to lower the cost of the F-35. Affordability of this program has always been an oversight issue, both for this committee and Congress. We welcome the President’s attention and the effect that this may have on the overall program and its cost.

I am looking forward to working with the new administration and the Department of Defense [DOD] to continue to explore ways to reduce costs in this program and other defense programs.

I will now turn to my ranking member, Ms. Tsongas.

[The prepared statement of Mr. Turner can be found in the Appendix on page 41.]

STATEMENT OF HON. NIKI TSONGAS, A REPRESENTATIVE FROM MASSACHUSETTS, RANKING MEMBER, SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

Ms. TSONGAS. Thank you, Mr. Chairman, and I would like to commend you for picking such an important topic to begin our slate of hearings in the 115th Congress.

For over two decades, the Department of Defense, the military services, and industry have worked to produce the most advanced fighter aircraft in history. As with any project of its size, scope, and complexity, the F-35 deserves appropriate congressional oversight. And I look forward to speaking with today’s witnesses to get a better understanding of how the Joint Program Office and the services plan to move forward with the program’s development and testing.

With that, I yield back and I look forward to your testimony.

Mr. TURNER. General Bogdan, you will be opening the hearing.

STATEMENT OF LT GEN CHRISTOPHER C. BOGDAN, USAF, PROGRAM EXECUTIVE OFFICER, F-35 JOINT PROGRAM OFFICE

General BOGDAN. Thank you, sir.

Chairman Turner, Ranking Member Tsongas, and distinguished members of the committee, thank you for the opportunity to address this committee regarding the F-35 Lightning II Program. I wish to keep my remarks short in order to allow more time for your questions.

I am happy to be joined today by three distinguished senior officers who represent our U.S. service warfighters on the F-35 program. These gentlemen are my customers, as well as 11 other allied nations who depend on the success of the F-35 program. As the program executive officer and program director, I work for

them as well as the taxpayers to ensure that we are delivering an affordable, reliable, sustainable, and effective F-35 weapon system.

The F-35 program today is much different and improved than it was 5 years ago when I first became the program executive officer. Today, the fleet of F-35s has grown to exceed 210 airplanes and has surpassed 73,000 flight hours.

The weapon system is considered operational and combat ready by both the U.S. Air Force and U.S. Marine Corps. It is also forward deployed today in Iwakuni, Japan, for the U.S. Marine Corps and operated in Israel and Italy by those F-35 customers. The three major areas of the program—development, production, and sustainment—have made significant and solid progress since the last time I appeared before you on this committee. Let me quickly address each.

With respect to development and flight test, we are now within a year of completing this phase of the program and delivering the full capability of the F-35 as it was envisioned in 2001 when this program began. Despite what you might hear, the development and flight test program is on track to finish within a few months and within the cost caps put in place 6 years ago in 2011, when the program was re-baselined. We are also making a smooth transition from development to a lean follow-on modernization program that has incorporated many of the lessons learned from the original F-35 program and other modernization programs such as the F-22 and the F/A-18 Super Hornet.

However, completing the development program is not without risk. I have often said that the mark of a good program is not that it has no problems, but rather it discovers problems, implements solutions, and improves the weapon system while keeping the program on track. I believe we have been doing that for years now and will continue to do so.

I am prepared to discuss, during our Q&A [question and answer] some of the challenges and risks we face today moving forward on the development program, such as our software; our Autonomic Logistics Information System, known as ALIS; mission data files; various C-model unique issues; and any other risks and challenges you might want me to address.

As for production, we delivered 46 of 53 airplanes last year. We were short on delivery of those airplanes due to a problem with peeling and deteriorating insulation inside the F-35A fuel tanks. The problem is now resolved, with all affected aircraft in the field repaired and the aircraft deliveries from our production line are recovering. We will be back on production schedule by this summer.

We are also in the middle of the largest ramp-up in the program's history, going from 61 aircraft in lot 9 to over 160 aircraft in lot 13, a nearly threefold increase in just 4 years.

I would like also like to thank the Congress for the additional 17 F-35s that the services procured in FYs [fiscal years] 2015 and 2016 as a result of congressional plus-ups.

The government/industry team remains laser focused on driving the cost of buying F-35s down. We continue to see lot-over-lot price reductions with the latest lot of aircraft, lot 10, being about 7½ percent less expensive than the previous lot 9.

Today, an F-35A model costs approximately \$94.5 million. It is the first time that an F-35 has been below \$100 million to purchase. We believe we are on track to continue to reduce the price of the F-35 such that in FY 2019, with an engine, including all fees, the F-35A model will cost between \$80 and \$85 million.

As part of this reduction, we have initiated a block-buy strategy for our foreign partners and an economic order quantity [EOQ] contracting strategy for the U.S. services. I am prepared to discuss this strategy with you as there has been much misinformation about what this block buy and EOQ strategy really is.

If the strategy is implemented, it will save approximately \$2 billion over the three lots of airplanes from FY 2018, 2019, and 2020.

Finally, the last major portion of the program, our logistics and sustainment area, is rapidly growing and accelerating. We are building a capability to globally maintain and repair F-35s in the Pacific, European, and North American regions. The ramp-up of depot capacity and heavy maintenance repair of components, warehousing, and our global supply chain is progressing well with all of our allies contributing to this global stand-up. We will also be adding 14 new operating locations around the world in the next 3 years, making the F-35 weapon system a truly global capability.

I am also prepared today to discuss in detail the two tasks that the F-35 was directed by Secretary Mattis. The first one is a Joint Program Office task to conduct a comprehensive review of all affordability initiatives we have implemented thus far in the program and to present future cost reduction initiatives we intend on implementing across the program in the future.

The second task is primarily a Navy task and it is to determine an appropriate, affordable, complementary mix of F-35Cs and advanced Super Hornets on the Navy's aircraft carriers in the future. I look forward to answering your questions about these two tasks.

In summary, the F-35 program is on a good trajectory today. The fleet is rapidly expanding and we are flying F-35s in the United States, Italy, Japan, and Israel as we speak. The development program is nearing completion within the cost and schedule boundaries put in place in the 2011 re-baseline. And the program is also continuing to successfully ramp up production and accelerating a stand-up of our global enterprise.

As always, our number one, overarching priority is to continue to drive cost out of this program while we deliver the full capability to our warfighters. We will continue to execute this program with integrity, discipline, and transparency, and I hold myself and my team accountable for the outcomes on this program. Our team recognizes the great responsibility we have been given to provide the foundation of future U.S. and allied fighter capability for decades to come.

We also recognize that someday, your sons and daughters, your grandsons and granddaughters may take this airplane into harm's way to defend our freedom and our way of life. It is a responsibility we never, ever forget.

Thank you for the opportunity to discuss the program and I look forward to answering your questions.

[The prepared statement of General Bogdan can be found in the Appendix on page 44.]

Mr. TURNER. Thank you.
General Davis.

STATEMENT OF LTGEN JON M. DAVIS, USMC, DEPUTY COMMANDANT FOR AVIATION, HEADQUARTERS, U.S. MARINE CORPS

General DAVIS. Chairman Turner, Ranking Member Tsongas, distinguished members of House Armed Services Subcommittee on Tactical Air and Land Forces, and other distinguished members, thank you for your continued support. All of us appreciate the opportunity to testify on the F-35 Lightning Program.

I am sure you are aware, the F-35B and the F-35C remain a top acquisition priority for the Marine Corps. We can't get into those airplanes fast enough.

You have my statement already printed out. I just returned last night from Yuma, Arizona, spent 3 days out there with our fleet forces and our NAVAIR [Naval Air Systems Command] team, talking about how we improve the readiness of the legacy platforms out there and we are making progress out there.

But I will tell you that, on average, Marine Corps tactical aviation is some of the oldest in the Department of Defense, if not the oldest. F-18s and Harriers, on average, 22 years old. These airplanes have performed brilliantly. We are extracting maximum value out of each and every one of them, but they are old airplanes. And we intend to extract maximum value, but it is getting harder and harder each and every day.

Also out there in Yuma, that is kind of the epicenter of Marine Corps F-35 operations right now, too. And bottom line, while that is taking place inside, outside, both day and night, the F-35s are overhead flying, training. And I will tell you, the pilots and the folks that are working on those airplanes and getting into those airplanes know, as I know, and I am becoming increasingly convinced, that we have a game changer, a war winner on our hands.

The United States Marine Corps is our Nation's force in readiness. We hold that responsibility to be a sacred responsibility. When the Nation's least ready, we need to be most ready, and that means not just against a low-end threat, but against the high-end threat. In an overmatch fight, we are convinced, I am convinced, we absolutely positively have to have this airplane in numbers as quickly as we can.

I will tell you that I have been flying Marine Corps airplanes—I have been in the Marine Corps for 37 years, flying Marine tactical airplanes for 36. I have commanded our Weapons School. I have not seen anything like this in the entire history of my time. I have flown AV-8s, I have flown F-18s, I still occasionally fly the F-5, not very well, but I still fly a little bit. This airplane is changing things in a big way, whether it is at Red Flag where the Chief of Staff of the Air Force says the airplane, F-35B, support of an Air Force operation, turned in a decisive effort.

The exchange rates, I read the blogosphere, 15 to 1, the last of Red Flag. I have seen the blogosphere, the retired Marine generals writing, that can't be true. I am like, it is true. I am not challenging that whatsoever. I see that in the last three WTI [Weapons

and Tactics Instructor] classes we ran at MAWTS-1 [Marine Aviation Weapons and Tactics Squadron One].

The scenarios that we could never get in before, that our airplanes got shot down and, more importantly, because we are always going to try to get in there and deliver that bomb for the marine on the ground, in simulated exercises we lost a lot of airplanes in scenarios that were fourth-generation airplanes and putting in both our Prowlers, our Hornets, and our Harriers.

That changed when we brought in fifth-generation airplanes, specifically F-35. We are achieving astonishing results in the highest threat scenarios and that across the range of military operations fight with the F-35. It is changing things in a very decisive way. We have taken it and deployed at the Twentynine Palms and lived hard, which is what we expect our marines to do. We have taken it onboard amphibious ships.

The last time we decided to see what we could do, we sent as many as we could afford to send with a deployment going on to Japan, we sent 12 airplanes to aboard the USS *America*. Fantastic, we took out V-22s, AH-1 Zulus and Yankees and operated out there for 3 or 4 days. It was seamless and it was exceptional and, I mean, a really great effort out there on the part of the team.

Last year we sent airplanes over to the, trans-Atlantic across to the United Kingdom. And just in January we sent our first operational squadron, VMFA-121, which is the first squadron to clear our initial operating capability [IOC], to Japan. So that squadron is in Japan now and if you read the press reports, they are not only just in Japan, they were at Okinawa supporting our marines on the ground and operating out there. So they are already operating fifth-generation STOVL [short take-off and vertical landing] airplanes in the Pacific, really inspiring.

And the last thing I will tell you, we just had a what we call a Marine Division Tactics class down in Beaufort, South Carolina. And we had a scenario out there, it was a 20 v. 8, 20 versus 8, 20 bad guys against 8 good guys; in those 8 good guys were 4 Marine F-35Bs. That was interesting; basically the 20 guys had a very bad day, I will leave it at that. The eight had a very good day. They all came home.

But what was most important, in the debrief, one of the pilots talking about all the kills they made, and the majority of the kills came from the F-35s, he was very clear, he was an amazing presence, he talked about what he did. And when they found out who he was, he was a CAT-1 student in our fleet replacement squadron, this was his graduation exercise. We have brand-new guys coming out of the training pipeline flying this airplane that are operating like Marine veterans that have 3 or 4 years' experience. I have never seen anything like it. I thought I would want to tell you about that today. That means we have an airplane out here and it is the beginning of its life that is going to grow and get more and more capability. I can't get those airplanes in the fleet fast enough to replace our F-18s and our Harriers.

And I will look forward to your support and I will answer any and all of your questions. Thank you.

[The prepared statement of General Davis can be found in the Appendix on page 75.]

Mr. TURNER. Admiral Miller.

**STATEMENT OF RADM DEWOLFE MILLER, USN, DIRECTOR,
AIR WARFARE (OPNAV N98), HEADQUARTERS, U.S. NAVY**

Admiral MILLER. Chairman Turner, Ranking Member Tsongas, and distinguished members of the subcommittee, thank you for the opportunity to appear before you today to discuss how the Navy and Marine Corps F-35C, with fifth-generation capabilities and fully integrated into our carrier air wings, will meet and exceed warfighting needs.

Along with our Marine Corps and Air Force team, the F-35C remains a naval aviation acquisition priority. The F-35C will form the backbone of Navy air combat superiority for decades to come, complementing the tactical fighter fleet with a dominant, multi-role, fifth-generation aircraft capable of projecting U.S. power and deterring potential adversaries.

The carrier air wing of the future must rely on the capacity and capabilities of both fourth- and fifth-generation aircraft. The F-35C provides unique capabilities that cannot be matched by modernizing fourth-generation aircraft.

Stealth technology and advanced integrated systems enable the F-35C to counter rapidly evolving air-to-air and surface-to-air threats; fifth-generation advancements shift focus from kinematics to information collection and dissemination in real-time battle space, enabling us to break enemy kill chains while facilitating our own. Coupled with the proven capabilities and capacities of a continually improving and relevant carrier air wing, the F-35C greatly enhances a carrier strike group's battle space awareness, lethality, and survivability to prevail in a high-end conflict.

The fiscal year 2017 President's budget supports the F-35C procurement to complete system development [and] demonstration, initial operations test and evaluation, initial operational capability, and to transition squadrons on a timeline that supports the first operational deployment on USS *Carl Vinson* in fiscal year 2021. The Navy also has a robust sustainment plan that supports operating this new aircraft and properly training maintenance crews and carrier air wing aviators.

Ultimately, the F-35C integrated and interoperable in the carrier air wing, the carrier strike group of the future will be more lethal, survivable, and able to accomplish the entire spectrum of mission sets to include immediate response to high-end threats. The Navy remains dedicated to a capabilities-focused approach as we evolve the carrier air wing and carrier strike group of the future. The dynamic security environment requires the speed, endurance, flexibility, and autonomous nature of the carrier strike group.

The Nation needs the tremendous capabilities of the F-35C on its carrier flight decks. The aircraft's stealth characteristics, long-range combat identification, and ability to penetrate threat envelopes, while fusing multiple information sources into a coherent picture, will transform the joint coalition view of the battlefield. I agree with my colleague General Davis, we have already seen it in practice so far.

The F-35C's capability will provide decision superiority to the Nation's warfighters to ensure that if deterrence fails, the United

States can conduct and will conduct decisive combat operations to defeat any enemy.

Thank you again for your continued support and I look forward to any and all of your questions.

[The prepared statement of Admiral Miller can be found in the Appendix on page 83.]

Mr. TURNER. General Harris.

**STATEMENT OF LT GEN (SELECT) JERRY D. HARRIS, USAF,
DEPUTY CHIEF OF STAFF FOR PLANS, PROGRAMS, AND RE-
QUIREMENTS, HEADQUARTERS, U.S. AIR FORCE**

General HARRIS. Chairman Turner, Ranking Member Tsongas, and distinguished members of the Tactical Air and Land Forces Subcommittee, thank you for the opportunity to continue our fifth-generation discussion for fighter capabilities.

When I spoke to you last at a field hearing in Dayton, we talked about the fifth-generation capabilities and now I intend to offer to you a glimpse of how the F-35A is performing and meeting our Air Force requirements as we continue to develop and procure this stealthy fighter.

Since we last met, the F-35A completed a trip to the United Kingdom, and also very recently successfully completed a deployment to Nellis Air Force Base and participated in Exercise Red Flag-Alaska. While we look forward to the fielding of the final system development and demonstration Block 3F aircraft, our operational pilots and maintainers at Hill Air Force Base are pleased with the F-35A in the Block 3i configuration.

General Carlisle in August of last year declared the unit IOC and the team has been performing remarkably well. Even though the Block 3i is an interim capability, the performance continues to excite the pilots. The pilots I have spoken with are pleased with the way the aircraft handles, and the destruction of targets, both in the air and on the ground, continues to be at rates higher than expected. The maintainers continue to produce combat-ready aircraft at impressive levels.

The team deployed 13 F-35A's and executed 207 of 226 planned sorties with zero maintenance non-deliveries, and maintained greater than a 90 percent mission capable rate. Nineteen sorties were mission canceled by the Red Flag staff for weather, not due to F-35 limitations. That is simply an awesome effort. And as you know, most fighter pilots will tend to exaggerate their claims and capabilities, but this morning's report with a 15 to 1 kill ratio is actually a little bit off the mark. Looking at the numbers, it was 20 to 1. The airplane is doing exactly what we need it to do.

The F-35A fleet is growing and will become a dominant force in our fifth-generation arsenal, deterring potential adversaries, and assuring both our allies and our partners at the same time.

Thank you for having me back. I look forward to your questions.

[The prepared statement of General Harris can be found in the Appendix on page 91.]

Mr. TURNER. Thank you, gentlemen. And thank you for the report on the progress that is being made with the F-35.

As I mentioned in my opening statement, President Trump has entered into the discussion on the cost of the F-35 and has raised the issue of the F-18.

General Bogdan, you have spoken to the President directly, and several times, on this issue. We all know that the F-35 can do the job of the F-18. The F-18 cannot do the job of the F-35, but you don't always need an F-35 to do the job. So the question is to that mix and how we proceed. It is an issue that I know, General Bogdan, you have been involved in and Admiral Miller. Secretary of Defense Mattis has tasked you and others with the prospects of putting together a report as to that comparison.

As we look to that issue, it certainly goes to the operational capabilities of the F-35, the environment that the F-35 and the F-18 enter into, but we certainly want to underscore the need for ensuring that we do acquire all of the F-35s that we need and that we have the F-18 capability.

General Bogdan, do you want to tell us how those conversations go? And I just want to interject for a minute. There has been some media reports that the President has called you directly and that, you know, that is breaking the chain of command. I know, having spoken to you personally, you are certainly up to that task, and I am glad that he picks up the phone and calls you. I will look forward to your answer.

General BOGDAN. Thank you, Mr. Chairman, and thank you for giving me an opportunity to address this directly.

The first time I met the President-elect was in mid December at Mar-a-Lago in Florida with a number of other senior DOD military officers. That discussion centered around the F-35 and the Presidential aircraft. Following that meeting, I had two follow-up phone conversations with the President-elect; one of them was on the 9th of January, one of them was on the 17th of January.

On the 9th of January, that phone call was just myself and President-elect Trump. On the 17th of January, the phone call was myself, President-elect Trump, and Mr. Muilenburg, the CEO [chief executive officer] of Boeing. It is important to understand that in the discussions that we had were all pre-decisional, there were no decisions made during those conversations, and it was my belief that President-elect Trump, at the time, was attempting to gain more information about the F-35 and its affordability, trying to gain more information about the F-35's capabilities relative to the Super Hornet, and to gain more information about the Presidential aircraft replacement program.

In fact, the questions that he asked and the answers that I gave were the foundation of the tasks that came out from Secretary Mattis 2 weeks ago, which are ongoing right now. The first of those being, what are you doing to ensure the affordability of the F-35 now and in the future, and how can we ensure that the taxpayers are getting a best value for their dollar.

And the second of those tasks was a Navy task about the complementary mix of Super Hornets, advanced Super Hornets, and F-35Cs on the deck of an aircraft carrier, where he was asking for a comparison of the capabilities. Those tasks are ongoing, they are not completed yet. We have yet to report the answers to the Secretary of Defense. I am sure as soon as we report those tasks to

him, he will then relay them to the appropriate folks in the administration.

Mr. TURNER. Admiral Miller, great segue then to you. I know from General Bogdan you can't report on the outcome, but you can give us some understanding of the elements that are being looked at. You know, our concern is one of ensuring that in having that complementary mix that we don't disadvantage ourselves, that we don't underestimate what future challenges will be and diminish what our overall assets will be in fighter aircraft. Could you give us some understanding of what elements that you are looking at?

Admiral MILLER. Yes, sir. It is interesting when you see how the task came and you hear the word "competing," that is not how the Navy views it. The Navy views our F-18 Super Hornet and its fourth-gen [generation] capacity and the capabilities that come with the exquisite F-35C as complementary.

In our view and per our 30-year aviation plan is that we end up with a carrier air wing mix, we grow to a mix that provides two squadrons of F-35Cs and two squadrons of Super Hornets. We feel that that mix, that complementary capacity of the Super Hornet and the capability of the F-35C is going to handle us well in the near term, and as we continue to grow that capability into the far term.

Now, both of these aircraft, just like every weapon system that we always have, continues to have to have a modernization program, so the F-35C follow-on modernization program addresses that for the F-35. F-18s are not unique in that regard, they also have a modernization effort, so just as do our ships and existing airplanes within the air wing.

Chairman Turner, you mentioned earlier about the readiness hearings where the vice chiefs were out and you see the extent where we sit right now. We have a shortfall in the Navy on our carrier flight decks, in our strike fighter, we call it strike fighter inventory management. So that mix and what we need to buy now and how we portray that throughout the FYDP [Future Years Defense Program] and in the following years will be something that we are going to take seriously. So we have to address our near-term issues as well as make sure that our warfighting needs are met.

Mr. TURNER. Thank you. Well, this is a program that everyone has looked at both issues of cost and time.

General Bogdan, this program, since 2010, has been on-cost and on-schedule. We are, however, looking forward and in doing so, seeing that we have concerns once again of increased costs and increased time. We look at finishing the program. We understand that the director of operational test and evaluation indicated that up to a billion dollars of additional funding could be required to complete the F-35 system design and development [SDD], which is currently scheduled to be completed in October of this year.

In addition, we looked at initial operating tests and evaluations. The belief was that the F-35 would be operational August 2017; now we look at those dates, might slip 2018 or even early 2019. General Bogdan, can you tell us where we are and what needs to be done so we can get back on track.

General BOGDAN. Thank you, Mr. Chairman. The portrayal that we need another billion dollars to finish the SDD program is inaccurate. Today, as it stands, the budget for the SDD program in 2017, 2018, 2019, and a very small amount in 2020 is short about \$532 million. And let me explain where that \$532 million shortfall comes from.

First, in 2014, the Department of Defense removed \$100 million of RDT&E [research, development, test, and evaluation] funding from the F-35 program to pay for higher priority things in the Department. That money was never paid back. So that would be \$100 million that we would just expect to get paid back just to get us to the baseline budget we have.

There were also \$165 million worth of new requirements that have been added to the program since 2013. Some of those include the need for a deployable ALIS. Some of them include some cybersecurity enhancements we needed to make to our off-board systems, like our mission planning system, as well as the airplane. Those were mandated from OSD [Office of the Secretary of Defense] and from the cybersecurity folks.

If you add those requirements, which were not paid for at the time we executed them, that is another \$165 million of added requirements that normally would have been paid for in the 2013, 2014, 2015 timeframe when we were executing them, that we are not because the Department asked us at that time to use management reserve to pay for those added requirements. That adds up to \$265 million.

The remaining \$267 million, to get you to 532, is the result of unexpected results we have had in our flight testing. We had an engine fire back 2½ years ago and we had to fix the engine. We had 3i software stability issues last year that required us to go in and fix that stability. We have had problems with the 3i and 3F software in terms of clutter and ghosting and things like that; we had to fix those issues, too. That is the added \$267 million, totaling the 532 that I need to finish SDD.

But here is the real important point about this: Every penny of that \$532 million is coming from inside the F-35 program with funding that I already have. It comes from management reserve, it comes from fee that our industry partners have not earned and will not earn, and it comes from negotiated saving that we have when we negotiate contracts in excess of the budget that we have been given.

So from our warfighters' perspective, I am not going back and asking them for a penny more than what they have already put into the program because the direction from the Department has been, General Bogdan, you will find the money for that \$532 million inside the program. And we have.

Mr. TURNER. General Bogdan, when you just mentioned 2014 and you lost dollars, we have had an environment of defense cuts that have affected modernization and also has affected readiness, sequestration being one of the big effects of that that has had devastating effects on our military. But I want to ask you for a moment if you could embellish the discussion that you just had on defense cuts, because so many times we get into the false discussion of, well, if the prices are high, we could just buy less. But the re-

ality is, is that buying less means that the costs go up. I mean, you have a fixed cost base that you have to maintain for the production line and equipment. And the marginal cost, again, the additional planes that you buy, actually overall lowers the cost.

Could you give us your thoughts on that, so that we can have people understand a little bit about what your challenges are?

General BOGDAN. Yes, sir. What you were mentioning there is a phenomenon in the acquisition world known as a death spiral. And it goes something like this. If I am going to buy a certain number of airplanes and each of those airplanes costs a certain amount of money and we budget for that, if budget is removed so you cannot buy that many airplanes and you have to buy less airplanes, the price of each of those fewer airplanes goes up. And then the future airplanes that you are going to buy also goes up, so the budget that you had doesn't go as far.

And that death spiral gets you to a point where ever-decreasing budgets result in ever-decreasing quantities, which result in ever-increasing unit prices on the airplane. And you get to a point where you are buying a whole lot of airplanes, I mean, very few airplanes for a whole lot of money. This program has not experienced that yet and will not experience that, because if we continue on the ramp rate that the warfighters need, the price of the airplane will continue to come down.

But when you take money away from the production program, every airplane in the future, the price then goes up on this program.

Mr. TURNER. Thank you, General. I think that that is a very important part of the discussion. As we look at the mix of the F-35 and the F-18, we don't want to say, we will just buy more 18s because then we can lower the cost on the F-35. Because in the end, if you reduce the production of F-35, you could result in spending more on both and getting less.

With that, I will turn to Niki Tsongas.

Ms. TSONGAS. Thank you, Mr. Chairman.

And I appreciate the testimony today just highlighting the extraordinary potential capabilities of the F-35 and how it is a game changer. But we all still wrestle with the cost and that is particularly true in the constrained environments in which we have been operating.

And General Bogdan, I appreciate that as there are additional costs that have been identified, and you reference \$532 million that are available so that it isn't going to require any new funding for the SDD phase.

I just wonder, if that \$532 million comes from inside the program, does that mean you routinely have a billion, half-a-billion dollars, just extra money available? And what else could we do with that money were this SDD phase didn't need these additional funds? Could we not buy more planes?

General BOGDAN. It is a great question, ma'am. The \$265 million of the 532 was simply payback for new requirements and, like I said, for money that was taken away. The \$267 million, clearly, if I can find that money inside the program and I didn't have to apply it to finish the SDD program, it could have been used for something else.

The normal procedure that I have when we do negotiate better contracts and when we do have fee that industry hasn't earned is, I turn to the warfighters and to the services and I say to them, what would you like me to do with that money? Would you like me to buy more airplanes, would you like me to keep it inside the program to pay for new requirements, or would you like me to give that money back so you can use it in other parts of your defense budget not F-35 related?

In this instance, when I identified the funds inside, we went back to the services and we went back to the Department, and the decision was made leave the money inside the program so that you can finish the SDD program. But you are correct, ma'am, that extra money could be used for other things. And unfortunately, it has to be used to complete SDD, the development program, because we had unexpected results, engine fires and things that we didn't expect to have happen that we simply needed to fix.

Ms. TSONGAS. But it certainly does highlight that there are large sums available when needed within the program. And I think my question really is about that fact, but I would actually like to go on to something else.

You have referenced that the \$1 billion estimate of potential future costs is inaccurate, and I am just curious how confident you are that you won't be coming back here in the next round, again suddenly the numbers have moved. How confident are you?

General BOGDAN. Ma'am, I am very confident. I have been running this program for 5 years now, and I have never once gone back to the services or to you to ask for more money. This is the first time, as we get near the end of SDD, where I have shown and been transparent about a budget shortfall.

However, given the fact that we negotiate large lots of airplanes, for example lot 11 is going to be somewhere in the order of above \$10 billion worth, if we can negotiate better deals for the price of those airplanes, then that money that I save in negotiating is the money that I will turn to the services and turn to the Department and ask, what would you like me to do with that?

Ms. TSONGAS. Well, I appreciate your confidence. I would like to ask another question now. The director of operational test and evaluation estimates that a significant delay in starting initial operational test and evaluation due to delays in getting aircraft modified and upgraded to the required standards.

In your written testimony, you mention a desire to start initial operational tests and evaluation earlier than currently planned, but with fewer test aircraft, and you cite several reasons for wanting to do that. A longstanding testing standard for operational tests are to ensure that fully capable production-representative aircraft are used, similar to those that will be operated by frontline service members.

If DOD does go forward with your plan, it appears that the testing would not be done with the previously agreed upon number of aircraft and with aircraft that are not fully upgraded with the latest combat capabilities. Do you agree that the testing will tell us all more if it is done as currently planned rather than taking shortcuts? Why cut corners?

General BOGDAN. Ma'am, I can assure you that my program office and I would never ever cut corners when it comes to delivering combat capability, because young men and women are going to put their lives on the line for that. However, having said that, it is a true statement that the original program of record was supposed to start initial operational testing in August 2017.

One of the requirements to start that full operational testing [OT] was to have 23 production-representative F-35s ready to go. I will not have 23 full production-representative airplanes ready to go in August. In fact, by February of 2018, I will only have 18 of those airplanes in a fully production-representative configuration. What I have asked the OT community to look at is an incremental start to operational testing, with those 18 airplanes and then over the next few months, add the additional airplanes to get them to the 23.

So the 18 airplanes that they would incrementally start OT with, would be fully production representative and would be fully representative of the combat capability of the airplane. There are a number of reasons why incrementally starting makes sense from a program perspective. One, every 6 months I delay OT costs another \$30 million. So it saves the Department and the enterprise money.

Second, the sooner I can get the feedback from the operational testers, who are the experts, the faster I can fix any problems that they find. And given that we are producing over a hundred airplanes a year on the production line, any time I can find something wrong with the airplane and fix it sooner means I can cut that into the production line quicker and I am not going to be producing airplanes that later on have to be retrofitted and fixed.

It is not my choice to start OT. What I do is I provide the resources to the OT community and they decide. All I have asked them to do is take a look at a way to potentially incrementally begin operational test, not such that at the end of OT or in the middle of OT they wouldn't have everything they need. But just to start it a little bit sooner with less than the full complement of airplanes.

Ms. TSONGAS. But this program does have a long history of discovering problems in developmental testing that has added many years to the program. So I just think it makes more sense to be more conservative when it comes to operational testing.

And with that, I yield back.

Mr. TURNER. To our vice chair, Paul Cook.

Mr. COOK. Thank you very much, Mr. Chair.

I had the pleasure of visiting Luke Air Force Base out in the desert. Now, I came in there and I had a number of questions which have been addressed. One was the helmet, the computer, the flight suit, the whole works, the cost overruns. And I got a chance to talk to a lot of the pilots. And I was really, really impressed with the pilots. The pilots, you know, I don't want to go into it, they actually were nice to me. Here is an infantry guy, they explained the acronyms, they used one-syllable words. It was really good. And then—got a great feeling.

The only hang-up I had was talking to the maintenance folks. And I am scared to death of the maintenance trail, just like I am with the Hornets and the problems and everything else like that.

General Davis, I think you made the point about, you know, the fleet is getting old, old planes. The chairman and I were out in Twentynine Palms, we were watching tanks, we were watching Harriers. And the planes, they were not as old as I was, but they are getting close. And every time I start talking maintenance, I get, you know, kind of a hesitation whether we are going to have this and I—the boneyards and I won't go through the whole thing. I want to get that feeling that okay—I am committed to the F-35, but God almighty we got to have everything in place to make sure that that maintenance trail of parts and everything else so that we don't have a system that is C4 or is C3 [degraded readiness]. Can you address that, anybody? General Bogdan.

General DAVIS. Hey, sir, thanks for visiting the Luke and thanks for visiting Twentynine Palms, God's country. And in my world, the aviators better be nice to the infantry officers or we will be without a job. That is why we exist, you know that in the Marine Corps.

Mr. COOK. How come there is no band then on the front of the plane then? No, okay.

General DAVIS. Yes, sir, it is right there. It is all good. Hey, we are, you know, we got underfunded in the spares account in this airplane early on and we are living that right now. So we have actually basically invested forward, tried to get additional help. We have asked for the spare parts to be put into the unfunded priority list to get that back up to speed.

This airplane is performing very well if it has got the spare parts and if there is no spare part for an airplane when it is down, whether it is Air Force, Navy, or Marine Corps, the marines, airmen, and the sailors will get it but they will take it off another airplane. That is debilitating, that is the wrong way to do business, so the spares accounts need to be funded. I think you need to hold us to account to make sure that they are. That the airplane comes in, the spares come in there as well.

And I think we talked about how impressed we are with the pilots. You know, I have got two, three squadrons right now of F-35s. The training squadron's got British Royal Navy/Royal Air Force maintainers in there as well, they are phenomenal.

Mr. COOK. General, since we are at the subject of Twentynine Palms, the expeditionary airfield out there, I have asked this question three times, but the F-35 is going to operate off that field which is very austere, it is sand, it is the dreaded FOD [foreign object damage], it is everything else.

And I have referred in previous committees, be it at Camp Lejeune, or "Lejeune" years ago, Lyman Road, you had to have a street sweeper to make sure there was no dust on the road. That is an austere combat environment. And is that F-35 going to be able to operate out of that when the wind and the dirt and the sand and everything else, just like it is in the Middle East?

General DAVIS. Sir, we did. We went up there and operated, did very well. I think that what we are finding right now is that the F-35B, with this engine, is less susceptible to FOD than our Harriers are. We have flown the F-35B now 26,000 hours. We have been up there to the strip, we have been to the estuary strips out there. We do hot combat loads out of Laguna Air Field and flying out of Yuma which, historically, is a very high FOD environment

for our Harriers. We have had four FOD events in 26,000 flight hours. That is .00016; that is really low. So I think we need to be careful about where we go and what we do, but we are learning.

Like one of the things we learned is, we would come into the pad, like we did in the Harrier, 100 feet across the pad and 100 feet in and let down. We are crossing now at 150, so we are learning as we go. So we are adapting our TTPs a bit, our tactics, techniques, and procedures, but we are finding a much lower prevalence for FOD on this airplane than we did in the Harrier.

Again, I think it is we are going to operate like the Marine Corps does with one foot ashore and one foot at sea and we haven't had any FOD events in any of our shipboard environments with the F-35B to date.

Mr. COOK. Thank you, General. I yield back.

Mr. TURNER. Jacky Rosen.

Ms. ROSEN. Thank you, Mr. Chairman. And thank you all for being here today and thank you for your service.

You know, I represent a district in southern Nevada, it is less than a dozen miles away from Nellis Air Force Base which, of course, is home to the U.S. Air Force Warfare Center, the largest advanced air combat training mission in the world. And one of Nellis' primary missions includes the testing of the Nation's most advanced aircraft and weapons systems.

Earlier this month, we were privileged to have the F-35, the advanced Red Flag exercises right there at Nellis. It is great for the people who live there. We see the planes flying around; it gives everybody a great chance to see some of the things you are doing. But I would like you to discuss how the F-35 performed in these exercises, what level of confidence you have in the test.

And as a former systems analyst and computer programmer, I am specifically concerned about your software capabilities, its susceptibilities to hackers and their ability to disrupt or disable an aircraft. Thank you.

Mr. TURNER. Yes, sir.

General HARRIS. Ma'am, thank you for the support for Nellis. It is an awesome location and certainly one that the Air Force enjoys to talk about, because there is so much going on that is on this high-end environment. And the exercise Red Flag that I spoke at, that the squadron deployed to, they performed extremely well. The maintenance was not an issue. The airplanes went out and as I said, the pilots were excited.

They had 145 air-to-air kills, which is the first time the F-35A has participated in a Red Flag, versus 7 losses. And all of those losses were within visual environment, in that, it means that they weren't seen on the radar, they were just seen passing by. And the way we run our Red Flags, because this was a high-end Red Flag, there were significantly more adversaries than there typically are and these adversaries were employing electronic countermeasures and had advanced tactics in an integrated air defense. So not just the air, but also the threats on the ground.

And the F-35 is one of the few, only fifth-generation-type airplane that can participate and fly inside of those threat environments. We would normally build an entire package of fourth-gen fighters to try and attack one of these sites. Yet the F-35 was able

to operate inside of those threats and had significant successes. They employed 51 simulated weapons against those SAM [surface-to-air-missile] sites with the success of killing 49 of them throughout the exercise, which is a huge number, much better than what we would have done in our fourth gen. And they were 92 percent successful on their heavyweight weapons delivery, which is far exceeding where we expected to be this early in the development phase. So it is going well.

Ms. ROSEN. Thank you.

General BOGDAN. Ma'am, to address your question about the software and the vulnerability, I would like to have you think of the weapon system in two pieces.

The first piece is the airplane itself. I can assure you, and we can't talk about it here very much, but I can assure you that the ability of this airplane to withstand software vulnerabilities from the airplane perspective is unmatched in the Department of Defense.

We knew when we started designing this airplane in 2001 it would be exported to other nations and other places. So we built in the special ways to protect the airplane. I have very, very, very little concern about the airplane itself.

I have a much greater concern about what we call the off-board systems, the maintenance system and the mission planning system, because those systems connect to other networks in DOD and with our partners and all of those networks become vulnerable.

But what I will tell you is, we have undergone over 150 vulnerability and penetration tests on our maintenance system and on our off-board mission planning system. And we found some things, and we are fixing them.

Some of that money I talked about that I had to spend extra, goes to the very heart of the cybersecurity issues that we have discovered that we have to improve for our off-board systems. But what I can tell you is, this is not something that the Department is taking lightly. We have the best experts in the Department trying to penetrate the system and showing us how to fix it. And we are in the process of fixing it. And in another forum, ma'am, I would like to be able to show you and tell you a little more about that.

Ms. ROSEN. Thank you, I look forward to that. And I yield back my time. Thank you.

Mr. TURNER. Martha McSally.

Ms. MCSALLY. Thank you, Mr. Chairman. Thank you, Gentlemen, for your testimony.

I was at Heritage Flight at Davis-Monthan this weekend. Climbed up the ladder of the F-35, talked to the pilots and maintenance. And it was great to have it there. It is an amazing capability that we do need—fifth-generation fighter, as fast as possible, as you have all testified.

My focus, as you all know, is on the low end of the spectrum and it replacing CAS [close air support] and combat search and rescue capabilities, where you need continuous coverage, loiter time, lethality, survivability from small arms, and those types of things. One of the important capabilities for that is a gun.

And so I have seen in some of the reports some challenges with the accuracy of the gun, the gun sight. So, General Bogdan, can you give an update on what is going on with the gun and testing and the way ahead?

General BOGDAN. Yes, ma'am, we are in the process of qualifying both guns on the A model, which is an internal gun, and on the B and the C model, it is a potted gun on the center line of the airplane. We have done ground testing, we have done in-flight testing and there are fundamentally two issues that we have to address in the coming months of development.

The first of those being, on the A model, when you shot the gun because it is off-center from the nose of the airplane, it creates a yaw. And as soon as the gun is shot, the nose of the airplane moves. And you know, ma'am, as an experienced fighter pilot, if you want to put the bullets on the target, you need to keep the nose steady.

Ms. MCSALLY. Exactly.

General BOGDAN. We know what the problem is, we have the software and flight control fixes in place and we are testing those as we speak. We will let you know if we need to continue to evolve the software and the flight controls to improve it. But we know what that problem is and we know how to fix it.

The second issue we have is with the heads-up display in the helmet; we don't have a fixed heads-up display. And, when you are aiming, and you would know this, I will keep it simple, the pipper, which is the little aiming reticle used to put on the target for where you want the bullets to hit, has to be fairly steady. And today, with the movement of the helmet and the movement of the airplane, that pipper is moving around too much.

Ms. MCSALLY. Right.

General BOGDAN. We understand that problem also. We understand the feedback loop between the airplane's motion and what is going on with the helmet. So we have those software fixes coded and in the airplane. Whether they prove to be sufficient such that the gun can be fired accurately remains to be seen. Those tests happen this spring and this summer. And we will let you know that.

But you are right, we have encountered some issues with the gun and we need to improve those.

Ms. MCSALLY. And there are also issues with moving targets, as I understand, and the ability to self-liaise versus buddy-liaise. And as you know, on a continuous CAS scenario, you are often yo-yoing the tanker as a Sandy [combat search and rescue] or a flight lead. So what is the status of that?

General BOGDAN. So I will just briefly talk about that and maybe let my warfighting brothers here discuss it. The original capability to hit a moving target on this airplane was embodied in a weapon that is no longer allowed to be used in our inventory. So we did have a capability that was on the books to hit moving targets. And when that weapon was removed from the U.S. inventory for treaty reasons, we lacked the ability to hit a moving target until our follow-on modernization program, where we will put in a moving target tracking capability with our targeting system.

In the interim, the Air Force and the Marine Corps have come to us and said in the meantime between now and about 2022 or 2023, with that moving target capability, we have another weapon that we would like you to introduce on the airplane. I am going to leave that with——

Ms. MCSALLY. Yes, I am familiar with that. And I appreciate it. We can follow up on that later. Thanks for the update.

My last question is to General Harris. And I agree what Admiral Miller said about the complementary focus of the inventory. And we have had many discussions about it is not the F-35 versus the A-10. I think we need both those capabilities in order to have full-spectrum operations. We have included in the NDAA [National Defense Authorization Act] a fly-off for the F-35 and the A-10 as part of the testing and evaluation.

And it seems the Air Force has made public statements that the A-10 is going to stick around for a while and maybe there would be a follow-on light attack aircraft. Is there any discussion to remove the A-10, replacement of the A-10 from the requirements document and just let the F-35 off the hook for that requirement? That would save resources, that would let the vendor off the hook and we would be able to move forward to have a complementary inventory of the F-35 and the A-10 or the follow-on to the A-10.

General HARRIS. Yes, ma'am that is a great question, thank you. I would expect that the F-35 is still going to be held to the same higher requirement of being able to do CAS as a mission. Because the Air Force feels that our multi-role fighter of the future needs to be able to do that.

Yes, we have determined that we are going to keep the A-10 and some other fourth-gen fighters for the next decades based on our F-35 buy rates. So we have the CAS as a mission and we expect all of our air-to-ground type airplanes to be able to——

Ms. MCSALLY. And I agree CAS is a mission in the environment that it needs to operate in. But I think, again, removing that specific requirement of replacing the A-10 or in the low end of the spectrum is something I would really like to follow up with the Air Force on. It would save some resources and allow us to move forward in a complementary way.

And I am out of time, so thanks, Gentlemen.

General DAVIS. Chairman, if I could, I would like, as a marine, our bread and butter is close air support, I would like to answer that, ma'am if you've got a second.

I am a career air pilot, so I am a—and I would actually challenge the F designation on the F-35. This is an F, it is an A for an attack, it is also electronic warfare. And we are seeing that. Our weapons school and our training range there is a small portion of that that is the fighter mission, it is a lot of the attack.

What I have found, it is different than the A-10 and the Harrier in that using the sensors on the airplane we have to do close air support. What I have got now in this airplane, what we have now as a nation in this airplane, is there is no place where my soldiers or sailors or airmen or marines are that we can't do close air support.

As you will see in the weapons school, to do CAS and be effective at CAS, you have got to have air superiority or at least localized

air superiority. This airplane allows you to do that in one package. We are doing fighter shots and bomb delivery at the same time. The other thing we are doing is through the weather with the APG-81. It is a picture-quality target view for the pilots.

And so we had a group out there that was trying to do close air support in North Carolina the other day. And they are out there flying and the forward air controller says the weather has moved in, I think we have to knock this off and [they] said hey, we see the target, let us go.

Ms. MCSALLY. And General, I couldn't agree with you more, I know I am way over at time, we need that capability, it is amazing. But we also need to be able to stay on station more than 20 to 30 minutes, have more than 180 bullets, have more than 2 bombs on station and be able to survive a direct hit. So we need both, from my perspective, but thank you.

Mr. TURNER. Well, Representative McSally, I want to thank you for your tireless effort to ensure that we have a close air support capability and your advocacy for the A-10. It is incredibly important that you bring your expertise, so thank you for that.

Turning to Mr. Carbajal.

Mr. CARBAJAL. Thank you, Chairman Turner and Ranking Member Tsongas. Thank you to all the witnesses for coming here today.

General Bogdan, I would like to focus on the issue of how we are planning to manage the follow-on modernization program known as Block 4. It is my understanding, DOD will not manage Block 4 as a separate and distinct acquisition program, despite it being a major acquisition program with the cost tag of almost \$3 billion over the next 6 years. This is of great concern considering this program has faced significant cost and schedule overruns and the cost for this program is now reaching \$400 billion.

The GAO [Government Accountability Office] has stated by managing Block 4 as a separate existing baseline, it will not be subject to statutory regulatory oversight requirements. It does not seem prudent for us to not subject this program to the highest degree of oversight and accountability.

General Bogdan, can you help me understand why the Department is against establishing Block 4 as a separate acquisition program?

General BOGDAN. Thank you for that question, Congressman. I will try and be as clear as I can about it. The Department's decision not to create a separate program for the follow-on modernization program has nothing to do with us not wanting to be absolutely transparent in what is going on in that program. It has to do with the administrative burden that is placed on starting a new program versus continuing a previous program and adding the modernization program onto it.

All of the documentation, and there are over a 100 documents that go along with starting a new acquisition program, all have to be redone and re-validated and re-signed when you start a new program. That administrative burden costs millions of dollars and takes months and months and months to get through the bureaucracy. That is not acquisition reform in my mind.

What we have told the Congress we would do, and I will stand here today and tell you again, that when we start the follow-on

modernization program it will be a separate contract, it will have separate earned value management. We will watch it and monitor it as a separate program in our SAR [selected acquisition reports] reports to you, and we will include in those SAR reports a separate baseline of the schedule and the cost and the performance of the program as if it were a separate program, just without the moniker of it being a separate program because of that administrative burden.

I have worked with the defense committees and your staffs to make sure that your equities in oversight are kept when we do this. Our promise to you is that we will be as transparent as if it were a separate program because it is billions of dollars. And it is your responsibility to make sure that we are spending those taxpayers' dollars wisely.

So my promise to you, Congressman, is when we set this program up we will set it up with separate reporting, with separate earned value management, with separate SAR reporting, and we will provide the Congress with all the transparency and oversight that you would require as if it were a separate program. We just don't want the DOD's administrative burden of a new program because that will add 6 months to a year to get started and tens of millions of dollars.

Mr. CARBAJAL. Just to conclude, as a new Member of Congress, I am informed that DOD is consistently tardy in getting information timely to Congress. How will you ensure that timely information is provided to Congress despite that infamous reputation that DOD has?

General BOGDAN. Congressman, what I will tell you is if it is the desire of this defense committee or any of the other defense committees to get monthly updates, quarterly updates of our earned value and our cost schedule performance progress on the system, we will do that. We will do that. Instead of the annual selected acquisition report, which comes out once a year, we would more than be willing to provide that data to your staffs or to you on whatever frequency you would like, sir.

Mr. CARBAJAL. Thank you. It is just that having served in the Marine Corps, timelines were very important. So when I hear this about DOD it kind of blows my mind.

General BOGDAN. Sir, I will tell you having the program office here in DC, and me being able to come up here and see you and the defense committees, makes that delay in the information flow a lot shorter, much to my chagrin sometimes. But I will tell you that our promise is that we will be as transparent as we possibly can because we do understand the oversight role that your committee and the other committees have.

Mr. CARBAJAL. Thank you.

Mr. TURNER. Mr. Gaetz.

Mr. GAETZ. Thank you, Mr. Chairman. And thank you all for your service and for being here.

I very proudly represent the warfighters who serve at Eglin Air Force Base in northwest Florida. And we are so proud to have the F-35 beddown there. We have got plenty of ramp space for more hopefully in the future. And I also am very proud to represent the

warfighters who are stationed at NAS [Naval Air Station] Pensacola.

And in my community, we know very well what it means to lose a pilot. We know the impact it has on the warfighters, on family members, and on the community at large. And so I was hoping, General Bogdan, that you could speak to the survivability analysis as we look at the F-35 and the F-18. Perhaps you could illuminate what some of the unique survivability features are that we can discuss in this setting for the 35.

And then, do you have an opinion that you can share now as to the relative survivability for pilots in the 35 to the F-18?

General BOGDAN. Thank you, Congressman. I will take the first part of that question. And then I am going to defer to my warfighters to give you some specific examples of what has gone on in some of the exercises that they have seen where their pilots come back and tell them how survivable this airplane is.

So the F-35 itself is survivable across a full spectrum. And in order to shoot down an airplane you have got to do a lot of things, okay? The first thing you have got to do is you have got to find it, okay? The second thing you have got to do after you find it is you have got to fix it in space so you know where it is. The next thing you have got to do is you have got to track it, so you have got to know where it is going.

The next thing you have got to do after that, is you have got to target it, meaning you have got to be able to know where it is going very, very quickly. And then finally, you have to put a weapon on it, whether it is a weapon that is shot from the air or from the ground. We call that the kill chain.

The F-35 can attack every point in that kill chain to remain survivable. It is not just about stealth. The stealth portion is the up-front part of that where it is hard to find it and fix it in space. But there are other things on this airplane, including electronic warfare, including other weapons, including information that other airplanes can give to you that at any point in that kill chain, it can be successful in stopping you from shooting down the airplane.

So it is just not about the stealth. It is about the fusion of the information, it is about the electronic warfare, it is about our countermeasures in the endgame if somebody does shoot something at the airplane. So the airplane is very, very survivable in almost all environments with most threats.

Now I will let my warfighter friends tell you about their experiences.

General DAVIS. That's good. I will tell you its survivability. It is not just the F-35 aviator, but it is also everybody that they are associated with, that—we don't just have airplanes just to have airplanes. We support folks on the ground, we support our folks fighting ships in any clime and place. I will tell you that this airplane is giving our pilots a decisive advantage.

He talked about the 20 to 0, the 20 to 1, the 24 to 0 that we have been enjoying out there at the weapons school. The zero means we are not losing these aviators. And it is not just a fighter threat, it is a very high-end SAM threat, which in days gone by would have been we would call it prohibitive interference.

And I ran a drill when I was a weapons CO [commanding officer], school CO in Yuma, we lost half the fleet and we didn't hit any targets. So in a simulation that is everybody comes back with a long face, talks about how bad the day was. In the real world, they are not coming back. So this is a very survivable airplane. I mean, incredible.

The analogy they talked about and just what General Bogdan talked about, in days gone by when in my youth we did it was almost like a football game, every player had their role, running backs, quarterbacks, linebackers, tailbacks. This airplane is more like a soccer match. Everybody has the opportunity be the killer. Everybody sees, everybody shares. And frankly, every exercise, whether it is Air Force, the Marine Corps, whoever is flying this airplane, embedded in a large package, it makes everybody else more survivable. The next WTI we are going to guide for a Marine artillery unit, the GMLRS [guided multiple launch rocket system], give them GPS [Global Positioning System].

We shot, basically working with the Navy, with the Aegis cruiser, in the desert simulation out there, but a real missile at a low-flying target out there, shot an Aegis missile with an ADL [automatic data link] and it was behind a mountain range, and direct hit. We tracked a missile going up out of Vandenberg from 300 miles away. It is changing survivability for everybody in a very positive way. We got something new on our hands, and I think it is very positive.

Admiral MILLER. Just to add on to that comment of increasing the survivability of everybody else, a carrier strike group fights in an integrated fashion. So we are mixing in this fifth-gen capability with our F-18E/Fs, with our E-2, with our Aegis-class cruisers and destroyers and then the capacity that that brings. And so, yes, F-35 is more survivable. But to the point that General Davis made about increasing that survivability for everybody else, it absolutely does that because then it is coupled with the lethality that comes with the entire strike group.

We talked earlier about maintenance and training, all of that, when we bring this onto our carriers, the entire package, making sure that the maintainers know how to operate it to keep that lethality in the air, to make sure—and we have already put F-35 out in our Top Gun classes out in Fallon, we talked about training out at Nellis, but Nellis and Fallon, that is as equally important so that our readiness is there when we ask for this capability that it is provided.

Mr. GAETZ. Thank you.

Mr. TURNER. Mr. Veasey.

Mr. VEASEY. Thank you, Mr. Chairman.

I wanted to ask you a question in relation to a sense of urgency with the development of a fifth-gen fighter, with regard to the F-35. Could you elaborate on how close our adversaries are in developing fifth-generation fighters with capabilities that may match or exceed ours? And wanted to specifically ask General Harris.

General HARRIS. Perfect, I appreciate the opportunity to respond to that. As we talked almost a year ago, there are several adversaries that are trying to copy our capabilities and sometimes it is the outer mold line, but what the fifth generation brings to us is also the internal piece. It is not just the stealth, it is the fusion

across the weapon system, it is the engines that provide the maneuverability, and we continue to have an advantage, but they are quickly closing that gap.

So we are trying to maximize our ability to procure fifth-generation airplanes and go from a 100 percent fourth-generation fleet to a significant mix of fifth generation so that we have the opportunity to operate in these hostile environments against these threats that are catching us faster than we thought they would.

Mr. VEASEY. As far as the internal capabilities of the plane, that involves a lot of technology. What are some issues that we may have that would make it hard for us to be able to keep up in regards to that area?

General HARRIS. Well, we are looking at the weapons that the airplanes employ so we not only have to have advances and continued with rapid acquisition of the airframe, but as we build them, we also must continue to update them, so the follow-on modernization program is very important to all the warfighters associated with the F-35.

The threats we look at, fifth generation is already making an impact in today's fight. Russia in Syria has deployed an S-400 system that would or could exclude all fourth-generation aircraft from there. But because we are flying fifth generation, not yet the F-35 but very soon, we will have that opportunity. It is the fifth gen that brings our ability to operate within that environment, hold those threats at risk so that we are able to come to the table as a lead, and not a near-peer, and continue to have America's domination where we need to across the globe.

Mr. VEASEY. And kind of in relation to that, I wanted to ask Admiral Miller about U.S. engagement around the globe and where would the F-35 have the most immediate impact today.

Admiral MILLER. Yes, good question, sir, I appreciate it. Where would they have the most immediate impact today? I will tell you that our carriers are globally deployed. And so today's fight, for the most part, is counterterrorism. And it certainly would contribute there, but that is not the high-end fight where the value of the F-35 we would see that value.

So what is the next trigger point? What is going to cause that carrier strike group to reposition and to find itself against that near-peer threat that General Davis talked about and General Harris talked about?

So we build and we bring in this capability for that sort of a threat. So to answer your question on the immediate impact, it certainly would be able to contribute in the fight we have today in Iraq and Syria.

Mr. VEASEY. General Davis. Sir.

General DAVIS. If I could, sir, I mean, if you watch the hands of time move and things change in the world, we talked about near-peer and peer competitors that are more closely coming to be a peer competitor. But for the high-end fight and for the low-end fight, a fifth-generation airplane is a very effective killing machine in all spectrum.

We also have the ability when we get the 3F capability to put pylons on this airplane. The Marine Corps has every intention of

doing that and I will be able to load up the F-35B with 3,000 pounds more ordnance than I can carry in a F-18 right now.

So we view this, it is a transformer. It can be a fifth-gen airplane for day 0 through 5 when, you know, I have got to bust in for days 5 through 60. I can put pylons on, operate from an amphibious ship, operate from 3,000 foot of 10 ashore[†] and basically go crush the bad guys, provide close air support to the guys on the ground and do what we have got to do.

And then if I have to go move someplace else, go back to a high-end force or the situation changes, they roll in those missiles, right, and we still have guys on the ground that we have got to support. Bottom line is the F-35 can go back to that low-signature airplane very quickly.

And with an airplane like in our Block 4, we get small-diameter bomb. Now you are carrying eight SDB IIs and internal to the airplane, plus a cannon. It allows you to survive in that high-end threat environment and do close air support, that is the game changer. The airplane can go back and forth and do it all. I think that is the powerful thing we have got coming our way.

Mr. VEASEY. Thank you, Mr. Chairman. I yield back.

Mr. TURNER. I am going to read the order here so people can understand the expectation of when the time is for questioning. We have got Banks, Brown, Bishop, Wittman, Langevin.

Going to Mr. Banks.

Mr. BANKS. Thank you, Mr. Chairman. And Gentlemen, thank you for your service. Thanks for being here today.

You have answered a number of questions already. This has been enlightening for a new Member of Congress, like me. But specifically, I have a question, General Harris, for you about the future of the National Guard, the future of the program for the Reserves, for communities like mine, the 122nd Fighter Wing, who might hope one day to pursue the F-35 as a program at our base, at our installation.

But more broadly, what does the program look like in the National Guard and the Reserves moving forward?

General HARRIS. Well, sir, that is a great question. We have, over the last 5 or 6 years, moved the Air Force through some of the concerns we had with our Guard and Reserve because over the last two decades our Guard and Reserve have been participating at extreme levels, much more than we would have expected a while ago for the rapidity of how often they deploy and the capabilities they bring to the fight.

And when you listen to a brief, when you look at the performance, you can't tell the difference between an Active, a Guard, or Reserve, it is all the same. Because of that, we are looking at the beddown of F-35s in the Guard and Reserve as we go along. So it is not an airplane that is going to flow to the Active first and then move to the Guard or the Reserve. We are already making those beddown decisions now. So as you can see, our next one has already been selected for the Guard and we are now looking at five and six where those are best going to be placed.

[†] "3,000 foot of 10 ashore" refers to a 3,000-foot airfield ashore.

They are a part of it, they are involved with us on a daily basis and specifically units, not every unit is going to get an F-35, but we have some of these that will continue to advance either in the fourth-gen capability as we modernize that and they can participate in small areas and also homeland defense. But then there will be a follow-on to the F-35, whether it is in an air superiority role complementary to the F-22, as the F-35 is, or that next generation after it, it may be a sixth generation. So I expect the Guard and Reserve to continue to be equal partners with the Active Duty.

Mr. BANKS. Thank you for your commitment to that. Thank you, Mr. Chairman. I yield back.

Mr. TURNER. Mr. Brown passes. Mr. Bishop.

Mr. BISHOP. Thank you.

First of all, I appreciate, Mr. Chairman, you hosting this hearing, as well as, Gentlemen, for showing up to it, that is very kind of you. I am glad I was able to free my schedule so I could listen to all of this; this is an important issue.

However, Mr. Chairman, you don't really have to start at 8:00 in the morning for me to free up my schedule. I can't for the future. He is not listening. Fine, all right.

[Laughter.]

Mr. TURNER. I was, I just don't have a response.

Mr. BISHOP. Yes, okay, fine, we will talk about that later, too.

General Bogdan, if I can, I am in a policy level here, I am an old history teacher so the specifics sometimes are mind-boggling. What I am trying to come up with is simply what our policy decisions ought to be. So if you could just tell me, you know, the recent Red Flag exercises you had, did the F-35 meet your expectations or did they exceed those expectations?

General BOGDAN. I will tell you, Congressman, from a program director's perspective, those results far exceeded my expectations. The idea that 13 airplanes could have a mission-capable rate of above 90 percent and they could fly 207 missions out of 226 and the only missions that they lost were due to weather or other reasons, with none lost to maintenance. At this point in the program where we only have 200 airplanes out there and we only have 73,000 hours of fleet time, which is about only 25 percent to 30 percent on the way to full airplane maturity, tells me that this airplane is just getting better and better and better, day in and day out.

Mr. BISHOP. Which becomes extremely significant, as our colleague from Florida mentioned. When we send the warriors out into battle, I don't want it to be a fair fight. That should not be our policy decision. And the value of a life is a significant component that can't be placed in simple dollars-and-cents terms, and that is why it is simply important that this generation of fighter becomes so much more significant than the fourth generation, because we are talking about real people here.

When you also mention the death spiral, as far as budgeting, that happens if we decide to cut spending. If we just do a continuing resolution, though, that simply moves the spending to the right and postpones it; is that having the same impact as if we actually authorize some kind of cut to it?

General BOGDAN. A continuing resolution in FY 2017 for the program is not as harmful as if it were going to last a very long time. And what I mean by that is right now I am in the throes of negotiating our lot 11 airplanes. It is 120 airplanes, that is FY 2017. In the continuing resolution, I am not allowed and not authorized to spend any more money than I did in FY 2016 or buy any more of the airplanes than I bought in 2016. So right now my hands are tied when it comes to negotiating lot 10.

Mr. BISHOP. So what we need to do is making sure that that could have the same impact as simply doing an outright cut to your program.

General BOGDAN. Yes, sir, it does.

Mr. BISHOP. Let me hit a couple other things. Look, you have talked also about the cost per unit. And this is a great aircraft, although I have to admit the B still looks like a 1957 Chevy. But other than that, it is still a great program here. If you can recall when I was young and we were doing the F-16s, how many were we producing a year?

Do you recall at the high point of that production what the number was?

General BOGDAN. I do not recall that, sir. I know it was more than 100.

Mr. BISHOP. I bet you weren't doing 43 a year back.

General BOGDAN. No, we were doing a lot more than that.

Mr. BISHOP. And the cost per unit still goes up, the smaller that is, that number, that lot is that takes place.

General BOGDAN. Correct.

Mr. BISHOP. Can I ask another question? When do we need to start working on the sixth generation?

General HARRIS. Sir, we started that long ago.

Mr. BISHOP. Which is another reason why we have to have the fifth in production and use it quickly.

General HARRIS. Sir, I would say that part of our termination of the F-35 program will deal partially with the numbers and the rates we are able to buy them, how fast we can get to the end, but also that we have another fighter available for procurement. The Air Force needs to be procuring more than 100 fighters a year with the 1,900-plus that we have now to replace them. Because right now the average Air Force fighter is 27 years old and that is a classic if we were automobiles in several States.

Mr. BISHOP. I will just do this in the 10 seconds I have got left. If there is an overrun on the next lot, who bears that burden? And is that different than in the first lot that came if there is an overrun?

General BOGDAN. Absolutely. If there is an overrun in the target cost of the lot of airplanes, that is born 100 percent by industry because the contracts we now negotiate with them on the top end of this are their responsibility and their risk.

Mr. BISHOP. And is that different from the first lot?

General BOGDAN. Yes, that is different from the first four lots of airplanes. We started that in lot five when I first came on the program to balance that risk, sir.

Mr. BISHOP. Thank you. I yield back.

Mr. TURNER. Representative Wittman.

Mr. WITTMAN. Thank you, Mr. Chairman.

Gentlemen, thank you so much for joining us today. And, again, thank you for your service to our Nation.

Lieutenant General Davis, I want to begin with you. You have spoken very eloquently about the F-35B and its capabilities. You did recently talk about the ramp rate for the F-35B, saying that it is anemic. Give me your perspective on where you think the ramp rate needs to be on F-35B procurement. And before you begin that, I just want to echo that you have an exceptional marine there in Major Glines. Go ahead.

General DAVIS. I know that, sir. Thanks very much for the question. I will tell you, the ramp rate right now has been anemic and it is manifesting itself that we are keeping our legacy platforms going longer. And frankly, we have got some inventory challenges out there on the flight line that are very difficult to address.

We are, with your help, we are basically pushing the numbers back up. But we won't recover our full readiness until some time in the future for what we need to do our job as a Marine Corps the way we need to do it. So right now the ramp rate is anemic.

We think, in talking with Lockheed Martin, that if we could get a few more a year we would actually be able to sundown our entire fourth-generation fleet of F-18s and Harriers by 2026. That cuts about \$2 billion worth of operating costs versus sustaining old airplanes that are not giving us the readiness we really need. They are tried-and-true, but it is like trying to get me—I did a marathon last year, sir. My first marathon, I was able to go out and walk around after. This last marathon, I had to lay still for a couple of days. And we are seeing that with some of our older airplanes. But we think, like, this year, I think, we are 16, 20, 20, 20, 21 for the F-35s. We think we could go to 19, 23, 23, 23, 31 and get a max production rate of 37 aircrafts in 23.

That pulls all that left and basically gets us out of the old metal earlier and gives our marines that capability they need to go fight our Nation's battle and collapses our readiness challenge in a significant way.

Mr. WITTMAN. Very good, our job is to authorize and fund that.

Rear Admiral Miller, I want to elaborate even more on where the Navy is. Admiral Moran, the Vice CNO [Chief of Naval Operations], came in the other day, talked about availability of F-18 aircraft, obviously very, very problematic. I asked Lieutenant General Davis about the ramp rate for F-35 for the Marine Corps. If the F-35 ramp rate for the Marine Corps is anemic, then I would say that the ramp rate for the Navy, the ramp rate has no pulse.

The question is, if we have these F-35 aircraft that have these exceptional capabilities that we need up there in the air that perform exceptionally, you had some recent tests of F-35 on the carrier, success there in those tests. This year we are on track to purchase two F-35s in the Navy.

Give me your perspective on how we have this seeming dichotomy, an exceptional aircraft the F-35, and what it can do. We have unavailability of current Navy inventory of F-18 aircraft. How do we bridge that gap? How do we make the right decisions to get to where we need to be?

Admiral MILLER. Yes, sir. I think you accurately depicted our current situation. First off, on the tests out at sea, we had some discussion earlier about Red Flag and that, for us, it was taking F-35C out to sea on USS *George Washington*. Very successful, we learned an awful lot.

But the one thing that really jumps out at you from a carrier aviator perspective: 152 arrested landings, 100 percent boarding rate. And this was bringing fleet pilots, our FRS [fleet replacement squadron] instructors out there. Pretty unheard of, zero bolters and zero "1" wires. So it does give us, you know, quite excitement for that. So we are working a balance.

We need to address the bulk of our fleet right now. We have four F-18 squadrons in every single one of our nine carrier air wings. And the availability is as the vice chief described it, so we have to get after that. A lot of different levers, of which one is depot throughput, the other is really the enabler accounts, your spares accounts, your PRE [program related equipment] and PRL [program related logistics] accounts that work tech pubs and updates to manuals and that sort of stuff, has been underfunded for many years and now we are starting to see the results of that.

So what do we need to do? We have to properly fund and start recovering that readiness of our existing F-18 fleet today.

Some of that, one of those—and then procurement is really another lever to pull. So I would contend that we need to, and our budget has asked for, at least through the unfunded priority list, additional F-18s to start applying towards that readiness.

As we ramp up, we are in a little different position than the Air Force and the Marine Corps with respect to F-35. Our first squadron doesn't start training until next year, and then we don't deploy until 2021. So we need to do that in a fashion such that we have the maintenance throughput, such that all of the systems on the ship, USS *Carl Vinson*, that is going to support that first deployment, that air-ship integration is fully in place.

So our ramp rate right now, even if you seriously changed it, would I have that throughput and what would that difference be. So I think for right now, our near-term focus is on the F-18 readiness issue that we have. And probably in the out-years, that is where all of a sudden we may have some opportunity to adjust that rheostat and change that ramp rate.

Mr. WITTMAN. All right. Very good. Thank you, Mr. Chairman. I yield back.

Mr. TURNER. Mr. Langevin.

Mr. LANGEVIN. Thank you, Mr. Chairman.

I want to thank our witnesses for your testimony today and we thank you all for your great service to our Nation.

Let me say, it is a pleasure to be a part of the subcommittee for the first time during my tenure on the Armed Services Committee. And I certainly look forward to working with you, Mr. Chairman, and our ranking member. I congratulate our ranking member for assuming her position in this role and, of course, the other members of this subcommittee.

So, General Harris and General Bogdan, I come from the Emerging Threats and Capabilities Subcommittee where I serve as the ranking member, where cybersecurity is one of our higher prior-

ities. So, many have been critical of cybersecurity inadequacies within the F-35 program. And I understand that the technology advancements in fifth-generation fighters will be operating on a netted enterprise that will rely upon advanced systems for data links, target mapping systems, and C2 [command and control] that could be vulnerable to cyberattacks.

So obviously, it is imperative that we understand the cybersecurity requirements for fifth-generation and beyond fighter programs in order to avoid further cost impacts, schedule delays, and possible cyber intrusions or vulnerabilities.

To this effect, last year section 1649 of the NDAA required an evaluation of cyber vulnerabilities in the F-35 aircraft and support systems. Can you explain how the current version of the F-35 software addresses security vulnerabilities found in previous versions? Do known vulnerabilities from previous software versions remain unpatched? And are there mitigation techniques for vulnerabilities that remain, whether inherited from previous iterations or new to the current version?

General.

General BOGDAN. As I said before, Congressman, if you look at the airplane itself, I think you will find that the architecture of the airplane, when it was designed early on, was, foremost in our mind was that we were going to export this airplane and other people were going to use it. Therefore, when we built the airframe itself, we ensured that there were things on the airplane that were protected.

I have no doubt in my mind, given the testing that we have done so far, that those safeguards on the airplane are working well. And the OT community today is doing the penetration testing and the vulnerability testing on the airplane itself. And those reports, when completed, we will make available to the Congress. They would not be publicly able to be seen, we would have to do that in another place.

But as I said, the bigger problem that we see is on our off-board systems that are connected to various networks. And when the system was originally designed, the maintenance system and the mission planning system on this airplane, we didn't know what we didn't know about the threats. And the threat cyber-wise continues to evolve day in and day out. So it is sometimes a catch-up game for us to be able to recognize what the current threats can do and figure out a way to get that into our systems.

Mr. LANGEVIN. Do we know, do you know if known vulnerabilities from previous software versions remain unpatched?

General BOGDAN. I will tell you that there are vulnerabilities in the system today that we know about that we are trying to fix. Can we fix them all at once with the flip of a switch? The answer is no. But we put other mitigation strategies in place to ensure that that vulnerability doesn't become a risk or a problem, additional inspections, where we use the system, how we use the system. But it is a true statement that today there are vulnerabilities that exist that we are trying to fix.

Mr. LANGEVIN. Okay. General Harris, do you have anything to add?

General HARRIS. Sir, I would also add that with cyber, all vulnerabilities generally go down to the weakest link, which means a lot of times it is our young men and women that are working on the airplane or plugging into it with something. So it comes back partially to training and making sure they understand the process and procedures they can follow and that social media and other things have no place in this type of an environment.

Mr. LANGEVIN. On that particular point, I believe we must consistently ask how warfighters are training and building confidence with advanced technologies that they are going to be using. And while I am new to this subcommittee, I believe that general principle holds true across disciplines. So how are we doing as far as pilots getting training hours to become confident in their abilities inside the aircraft before they take to the skies in combat scenarios?

General HARRIS. Sir, we are doing well on that. We are working through the simulated environment to make sure that they get that training before the first sortie and that is actually part of the congressional help that we had at Luke Air Force Base, standing up the simulators and the facilities.

The team is doing extremely well, the maintainers and the tech training, so that by the time they go out and complete their training, whether it is as an operator or maintainer, the results speak for themselves at Red Flag; 92 percent MC [mission capable] rates are better than we are seeing across any other fighter fleet.

Mr. LANGEVIN. Thank you, General.

Mr. Chairman, I would hope that the report that General Bogdan referred to, once it is available, will be forwarded to the committee so we understand the cyber vulnerabilities that haven't been addressed or still remain. And I have some other questions I would like to submit for the record if possible. With that I yield back.

Mr. TURNER. Great. Thank you. Well, Representative Langevin, you have been a great advocate on the issue of cyber so we appreciate your comments.

With unanimous consent, I recognize Doug Lamborn.

Mr. LAMBORN. Thank you, Mr. Chairman, for letting me join this important hearing.

I am a strong supporter of the F-35 program. Fifth-generation capabilities are essential to our Nation's defense. I do remain concerned about the pilot escape system, especially the ejection seat. So I have a few questions on that. And I am not sure who to direct this to specifically. Okay.

Thank you, General.

As you know, the Air Force discovered that pilots who weigh less than 136 pounds were at high risk of severe injury or death during ejection. The program review last year by the director of operational test and evaluation from OSD stated, quote, "The extent to which the risk has been reduced for lighter-weight pilots by the modifications to the escape system and helmet is still to be determined by a safety analysis of the test data," unquote. So that is what I am going to pursue.

So first of all, how many tests to date have you done to qualify the Martin-Baker ejection seat for the F-35?

General BOGDAN. Multiple different kinds of tests, but if you are talking about the actual no-kidding, shooting the ejection seat with a dummy in it to check, I believe we have done on the order of about 19 to 23 tests.

And we are completed now with all of those tests. The last few tests that we did over the last 5 or 6 months included the three fixes that were necessary to reduce the risk of those lightweight pilots in an ejection scenario. The first of those fixes was a lighter helmet, and we have built those lighter helmets and have them now.

The second was a sequencer switch on the seat that could be selected by the pilot if he is a lightweight pilot or heavyweight pilot. And that reduces the opening shock on ejection.

And the third is a head support panel that is placed on the risers so that when the parachute does come out during ejection, the pilot's head cannot be snapped back. All three of those fixes were designed, all three of those fixes are now tested, all three of those fixes are now getting ready to be cut into production.

The one last test I have to do for the entire ejection seat system is put all of those together and fire electrons at it to make sure our triple, we call it triple E testing, triple E testing is done. That testing is scheduled in March, sir.

As soon as those tests are complete, we will have all the reports necessary to hand to the services so that they can make the determination that the risk has been reduced enough to lower the weight of the pilots.

We are not waiting for that. We are now putting the kits together to retrofit all the airplanes out there with the lighter helmets, with the helmet support, and with the switch so that if the services give us the okay in April we will start modifying airplanes.

The data that I have seen so far, and it is not the final data, indicates that we have reduced the risk not only for lighter pilots, but all pilots in the F-35 from a problem with neck loads with these three fixes, and that is an improvement across all of the pilot population. And we will be able to remove that restriction down to 103 pounds. But it just took some time to get it done and now we are getting it done.

Mr. LAMBORN. And I know that there is another model out there or available. And I want to really be making sure that we compare the risk of what is currently in place versus the alternative model that is available to make sure we are not having unacceptable risk to our highly trained and valuable pilots.

General BOGDAN. And we agree with that. When we did originally pick the Martin-Baker seat over an ACES [Advanced Concept Ejection Seat] seat, that risk was done. In 2010, the U.S. Air Force did a second look to make sure that the Martin-Baker seat was the right seat and they did it.

But notwithstanding all of that, with the three fixes we have had to make, the Air Force has sent me direction that they want me to relook once again to make sure that the Martin-Baker seat is fully capable of protecting our pilots as best we can and compare that to what a future ACES seat would look like. We are in the process of doing that right now.

Mr. LAMBORN. Thank you. I am glad, glad to hear that.

General BOGDAN. We are doing that right now.

Mr. LAMBORN. And a couple background questions real quick before my time is up. What is the total cost to the program that has been incurred because of all this 19 to 23 tests and the future test you are talking about?

General BOGDAN. Zero. When the problems with this occurred, we went back to industry and said we believe that we have given you enough time and enough money to design the seat appropriately. Therefore, any changes that have to be made in the engineering, the retrofitting, and the production cut-in are to be borne by industry and not the government, and they agreed.

So right now the U.S. Government is not paying for any of those fixes, sir.

Mr. LAMBORN. Okay, thank you. Mr. Chairman, I yield back.

Mr. TURNER. Gentlemen, we have come to the end of the hearing. I wanted to give you an opportunity if any of you have additional comments for the questions that have been asked or for information you think would be important for this committee. I want to give you the opportunity to take this opportunity. Any additional comments?

General BOGDAN. Sir, I just want to thank the committee for your continued oversight. I have been on the program for almost 5 years. I have a tremendous working relationship with your staffs and I appreciate that. We try and be as open and as transparent as we can. We understand you have a tough job to do.

I will tell you this is not the same program it was many years ago. And we appreciate the support that this committee has given to the F-35 program. Thank you, sir.

Mr. TURNER. Great, thank you. And with that we will be adjourned.

[Whereupon, at 10:53 a.m., the subcommittee was adjourned.]

A P P E N D I X

FEBRUARY 16, 2017

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

FEBRUARY 16, 2017

Statement of the Honorable Michael Turner
Hearing on Military Services 5th Generation Tactical Aircraft
Challenges and F-35 Joint Strike Fighter Program Update
February 16, 2017

The hearing will come to order.

The subcommittee meets today to receive testimony on the military services 5th generation tactical aircraft challenges and to receive an update on the F-35 Joint Strike Fighter program.

I want to welcome our distinguished witness panel for today:

- Lieutenant General Chris Bogdan, United States Air Force, F-35 Program Executive Officer;
- Lieutenant General Jon M. Davis, United States Marine Corps, Deputy Commandant for Aviation;
- Rear Admiral DeWolfe “Chip” Miller, United States Navy, Navy Director of Air Warfare; and
- Lieutenant General (Select) Jerry D. Harris, United States Air Force, Deputy Chief of Staff for Plans, Program and Requirements

Gentlemen, we thank you for your service and look forward to hearing your testimony today.

Before we begin I would like to take care of some administrative details.

I’m pleased to announce that Paul Cook will again be serving as the vice chairman of this subcommittee. Paul, thank you for agreeing to be vice chairman.

I now would like to introduce the new GOP members of the subcommittee, and then turn to Ranking Member Tsongas to introduce the new Democrat members.

Don Bacon represents Nebraska’s 2nd Congressional District. A retired Air Force Brigadier General, Don has commanded twice at the wing level, at Offut Air Force Base and Ramstein, Germany.

Matt Gaetz represents Florida’s 1st district, home of one of the largest military districts in the country, including Naval Air Station Pensacola and Eglin Air Force Base.

Trent Kelly represents Mississippi’s 1st district. A Colonel in the Mississippi Army National Guard, he has served for 30 years as an Engineer, including multiple tours in Iraq.

Jim Banks represents Indiana’s 3rd district, home of 122nd Fighter wing of Indiana National Guard. A Navy supply officer, he has recently completed a tour in Afghanistan.

We’re glad to have you as members of this subcommittee.

This is a timely hearing and is complementary to last week's full committee hearing on the "State of the Military."

Last week the committee heard testimony from each of the military services' Vice Chiefs of Staff that the force is strained, and that the Services have to do more with less.

These challenges, combined with years of budget driven national security strategies and cuts, rather than threat-based strategies, have led to a military readiness crisis.

With a new Administration indicating its intent to "rebuild the U.S. Armed Forces," I look forward to working with them to reverse this harmful trend in military readiness.

Modernization and building capacity are critical components to restoring readiness.

This brings us to today's hearing focus on 5th generation tactical fighter requirements and the F-35 Joint Strike Fighter program.

This is the third oversight hearing the subcommittee has held over the past year on the requirements and importance of fifth generation fighters given current and emerging threats.

One of those hearings was at the National Museum of the United States Air Force at Wright-Patterson Air Force Base on June 18th, 2016, and the witness, then Major General Jerry Harris, here with us today, and then the Vice Commander of Air Combat Command, showed us a striking picture of one half of an F-35 Joint Strike Fighter and one half of a Chinese J-31 fighter joined together.

It looked like one aircraft, and left no doubt in anyone's mind that our adversaries are extremely close to fielding fifth generation fighter programs of their own.

With only 187 F-22s and 219 F-35s produced, we have very limited 5th generation capacity.

The F-35 Joint Strike Fighter program is nearing the end of its development program and is over 90 percent complete.

It's no secret the F-35 development program has faced some significant challenges in cost and schedule overruns early in development. After being re-baselined in 2010, the program has been successful in meeting cost and schedule goals.

Although F-35 development is scheduled to be completed by October of this year, General Bogdan has noted in previous updates that there remains about three to four months of schedule risk to completion of the F-35 development program and additional costs could be incurred.

In terms of oversight, the subcommittee remains concerned about the costs associated with closing out the F-35 development program, the maturity of the program to potentially execute a Block Buy for fiscal years 2018 through 2020, and determining whether more efficient program management can help accelerate the initial operational test and evaluation program. We

expect to gain a better understanding of these important oversight issues today.

During our hearing last July on 5th generation fighters, General Herbert “Hawk” Carlisle stressed that fourth-generation aircraft play a significant role in the near term in addressing fighter capacity and inventory concerns since we have few operational 5th generation fighters.

He also noted the importance of 5th generation fighters, “The role of our 4th Gen fighters will diminish over time due to two main reasons: The first is they will age out and be replaced by more capable F-35s. But more pressingly, our 4th generation fighters are more increasingly unable to operate in highly contested environments where advanced air defense systems render them ineffective.”

Given current fiscal constraints, the military services are being forced to prioritize between building capacity in 4th generation tactical aircraft inventory to help mitigate some of the immediate readiness burdens on the current force or trying to accelerate needed 5th generation tactical aircraft capability.

For National Security purposes, it’s not a question of one or the other...the answer really is that we need to do both.

In closing, there have been several reports and comments in regards to the President’s concerns for the need to lower the costs of the F-35 program. Affordability of this program has always been an oversight concern of this committee.

I am looking forward to working with the new Administration and the Department of Defense to continue to explore ways to reduce costs in this program and other defense programs.

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THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

STATEMENT OF

LT GENERAL CHRISTOPHER C. BOGDAN
PROGRAM EXECUTIVE OFFICER, F-35

BEFORE THE

TACTICAL AIR AND LAND FORCES SUBCOMMITTEE

OF THE

HOUSE ARMED SERVICES COMMITTEE

ON

F-35 PROGRAM REVIEW

FEBRUARY 16, 2017

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

I Introduction

Chairman Turner, Ranking Member Tsongas and distinguished Members of the Subcommittee, thank you for the opportunity to appear before you to discuss the F-35 Lightning II.

The F-35 Program is a much different and improved program than it was 5 years ago. The F-35 weapon system is now operational and forward deployed. The size of the fleet continues to grow and we are rapidly expanding its capability. The F-35 will form the backbone of United States (U.S.) air combat superiority for decades to come, replacing or complementing the legacy tactical fighter fleets of the Air Force, Navy, and Marine Corps with a dominant, multirole, fifth-generation aircraft, capable of projecting U.S. power and deterring potential adversaries. For our International Partners and Foreign Military Sales (FMS) customers who are participating in the program, the F-35 will become a linchpin for future coalition operations and will help to close a crucial capability gap that will enhance the strength of our security alliances.

The Program's costs are well understood, stable and with respect to production and operating costs, they are decreasing making the F-35 more affordable each and every day. The costs to complete the Development program still remain well within the budget established in 2011 after the Nunn-McCurdy Breach.

Our overall assessment is that the program is making solid progress, as it grows and accelerates; and shows improvement each day as we continue to manage emerging issues and mitigate program risks.

II Accomplishments

The F-35 fleet now exceeds 210 aircraft and it has surpassed 73,000 flight hours. The program continues to execute well across the entire spectrum of acquisition, to include

development and design, flight test, production, fielding and base stand-up, sustainment of fielded aircraft, and building a global sustainment enterprise. We are again pleased to report many accomplishments by the F-35 team during the past year but none are more satisfying than the declaration of Initial Operating Capability (IOC) for the F-35A by the U.S. Air Force (USAF) last summer and seeing the U.S. Marine Corps (USMC) forward deploy its F-35Bs.

The F-35 program had two overseas deployments and two additional sea trials this past year. The first deployment took two Dutch F-35A aircraft from the U.S. to the Netherlands for three weeks. The Dutch conducted a noise survey and introduced their people to the F-35s by flying it all around the Netherlands and flying it and displaying it at their annual airshow.

In June of last year, the USAF, USMC and the United Kingdom deployed 2 F-35As and 3 F-35Bs to England where the F-35 Lightning II made its debut at the Farnborough International Airshow and Royal International Air Tattoo in the United Kingdom allowing our European partners and allies a chance to see the F-35s and learn more about its capabilities. Additionally, the program completed its final round of sea trials with the USMC's F-35Bs aboard the USS AMERICA and with the U.S. Navy's (USN) F-35Cs aboard the USS GEORGE WASHINGTON. During these sea trials, the F-35Bs completed 60 sorties in 21 days and the F-35Cs completed 41 sorties in 19 days.

The F-35 Development Test (DT) team also completed all F-35A envelope testing and all F-35C aerial refueling testing in 2016. In addition, this year marked the successful in-flight firing of the F-35A internally-mounted GAU-22 25-millimeter cannon and the ground testing of the F-35B and F-35C centerline cannon pod. Air-to-Air accuracy testing of the GAU-22 is expected to complete spring 2017. Furthermore, there were several milestones with the United

Kingdom, including successfully testing its aerial refueling tanker's compatibility with the F-35 and first flight release of its unique weapons.

The program also successfully upgraded all Block 2A aircraft to the newer more capable Block 2B configuration. Today all F-35s in the field are either Block 2B aircraft or Block 3i aircraft, with both Block 2B and 3i having the same limited warfighting capability. The Block 3i software stability issues we reported on last year were corrected and the final iteration of software, Block 3F, is now in flight test and continues to mature.

The DT program achieved some significant milestones in 2016, flying 1,447 DT flights, performing 63 weapon separations and executing 16 Weapon Delivery Accuracy (WDAs) missions, all of which were the highest annual totals in the F-35 program's history. The program also executed a highly concentrated WDA test phase where 12 WDA tests and 13 weapon separations were accomplished in a 1 month span across multiple test ranges, outpacing a historical execution rate of roughly 1 WDA every 5 weeks.

The Autonomic Logistics Information System (ALIS) successfully supported Development and Operation test events demonstrating the deployability of the ALIS system ashore and afloat. Lessons learned were collected and incorporated into the ALIS Deployment Guide which was delivered to the users to help them more quickly and easily breakdown, move and set up the deployable ALIS. Further, the ALIS Operational Representative Environment (ORE) at Edwards Air Force Base in California is now testing the latest versions of ALIS before fielding to the operational fleet. This was an important improvement in delivering a better ALIS system to the warfighter. This testing has been highly successful in identifying software deficiencies that have proven difficult to identify in industry laboratories during earlier phases of

testing. The results of these findings from the ORE will result in fielding a more stable, better ALIS system with fewer discrepancies than in the past.

Understanding that the F-35 could be subject to hostile cyber environment, the program undertook more comprehensive cyber penetration testing for the ALIS and the F-35 air vehicle as a whole. This testing has facilitated improvements to ALIS cyber protection capabilities and procedures. In addition to this vulnerability, the F-35 Joint Program Office (JPO) with the Joint Operational Test Team (JOTT) has planned additional assessments in early to mid-2017 for the newer ALIS 2.0.2 release. We continue to work closely with the JOTT on planning and executing future ALIS and air vehicle cyber security testing throughout the life of the Program.

III System Design and Development

System Design and Development (SDD) Schedule: Steady progress is being made toward the completion of the SDD program. There are two important milestones associated with the closeout of this phase of the program: completion of SDD flight test and the delivery of the full Block 3F capability. It is important for the committee to understand that the end of SDD will be event driven. The JPO/Industry team will continue SDD until the full Block 3F capability is delivered to warfighter. There is no intention of truncating the program on any specific calendar date or at some predetermined budget-level. With respect to completion of F-35 flight test, the original 2011 re-baseline Program of Record showed flight testing to end on 31 October 2017. The JPO has always believed there is 3 to 4 months of risk to this completion date, putting the end of SDD flight test in February 2018. This risk adjusted date is the result of a number of flight test delays experienced in the past 2 years including the F-35 engine fire which stopped flight testing for 2 months and software stability issues and fusion issues with the

Block 3i software which have delayed Block 3F flight testing.

The Department of Defense (DoD) has directed the JPO to maintain the resources necessary to continue flight testing to May 2018, if necessary, to ensure we will deliver the full Block 3F capability. The biggest risks to the timely completion of SDD flight testing include software stability, the discovery of new software deficiencies, the time it takes to correct deficiencies, and the health of our DT test fleet.

The second important milestone leading to the completion of SDD is the delivery and fielding of the full Block 3F capability including the full aircraft and weapons envelope. The following table shows the program's estimates of when these full capabilities will be delivered.

Full Block 3F Capability Delivery	
2011 Post Nunn-McCurdy APB Dates	Current Estimate
Objective: August 2017	F-35A: October 2017 (w/o AIM-9X) November 2017 (w/ AIM-9X)
	F-35B: November 2017 (1.3 Mach) May 2018 (1.6 Mach)
Threshold: February 2018	F-35C: January 2018 (1.3 Mach) February 2018 (1.6 Mach)

As you can see from the table, the delivery of the full capability for all 3 variants falls within the original 2011 Acquisition Program Baseline dates with the exception of the B-model envelope between 1.3 and 1.6 Mach which is slightly delayed, due to having only one B-model test aircraft (BF-3) properly instrumented for the testing needed to get to 1.6 Mach.

SDD Cost to Complete: The remaining SDD work is estimated to cost \$2.3 billion which includes an additional \$532 million above the current funded program. The additional funding is needed due to several factors. First, there were additional requirements added to the program during SDD (e.g., deployable ALIS, mandated program security changes, mandated aircraft cyber security changes) which were never paid for at the time they were executed. These new

requirements totaled \$165 million. Secondly, DoD removed \$100 million from SDD funding in prior years to pay other higher priority bills and this money was never restored to the Program's baseline SDD budget. Finally, a shortfall of approximately \$267 million was caused by unforeseen events, such as the 2014 engine fire and the delay to Block 3F testing while the Program improved Block 3i software stability and fusion issues, both of these issues resulted in added schedule and cost to the competition of SDD. The \$265 million of "payback" along with the \$267 million due to unforeseen events resulted in a need for an additional \$532 million. This money as mentioned above will be sourced from inside the F-35 Program using management reserve, unearned fee and the savings resulting from negotiating lower costs on various contracts. Use of this internal funding will result in no impact to any other DoD programs or the Services/DoD's budget requirements. Additionally, as mentioned previously the Department has directed the JPO to maintain the resources necessary to continue SDD flight testing to May 2018. Should flight testing beyond February 2018 to May 2018 be necessary the JPO will hold \$100 million of Follow-on-Modernization (FoM) funding in fiscal year (FY) 2018 to pay for this added flight testing.

As a final note on the SDD budget, it is important to look back to the 2011 Rebaselined Program and compare today's cost estimate to complete SDD with the cost controls put in place after the Nunn-McCurdy Breach. The following table makes this comparison.

SDD Cost Baseline	
2011 Post Nunn-McCurdy 2011	Current Estimate
Objective: \$13.9 B (50 % probability)	\$13.9 B
Threshold: \$15.1 B	delta = \$267 M (discoveries)
	Total = \$14.2 B

As the chart indicates, the Program has remained within \$267 million (2.1%) of the 2011

Objective Budget Estimate and well below the Threshold Budget Estimate, indicating that the fiscal discipline and cost control measures executed by the Department have been effective.

SDD Risks: At this time last year and in response to software stability problems, the Program had launched an in-depth look at the architecture by a “Software Stability Red Team.” After a wide-ranging technical analysis, the team confirmed that the F-35’s basic software architecture is sound and can support the full Block 3F warfighting capability. However, the team also identified that the end-to-end testing of the software needs to be streamlined and improved, and the metrics used to track software performance need to be updated to reflect operational considerations.

One significant improvement that has been made over the past year, is the ability of the JPO/Industry team to find, fix, code, lab test, and deliver to flight test a new increment of mission systems software in 30 to 45 days. Previously during Block 2B and 3i software development and testing this process took approximately 3 to 4 months. Now with better software tools, faster feedback from the testers, and a streamlined airworthiness process we have cut this timeline significantly. This has greatly improved our ability to fix emerging software issues and field better software sooner. We intend on building on this success as we move to FoM. Additionally, the JPO implemented a new method of tracking software stability that takes into account at what point in a mission a stability event occurs and the operational impact of that event. These changes will provide better insight as to the causes and circumstances of these stability events and better position the program for more stable, effective software in the future.

Currently the stability of our Block 2B and 3i software is exceeding our initial estimates in terms of stability. Today the Block 2B software experiences a software stability event once

every 29 flight hours and Block 3i experiences a software stability event once every 25 flight hours. By way of comparison, our target for this stability was approximately one event every 10 flight hours. Although the Block 3F software is in its early stages of flight testing, we are seeing stability data indicating it will exceed the 20 flight hour mark before experiencing an event.

Block 3F Software Risk: An additional risk to completing SDD on time with Full capability within the JPO's budget is the level of complexity of the new capabilities in Block 3F software. For example, Block 3F software must take information from other sources, such as other non-F-35 aircraft, satellites, and ground stations and fuse this information with F-35 information, giving the pilot a complete and accurate picture of the battlespace. We are also fielding the capability for more than 4 F-35s, in some instances up to 8 and 12 F-35s to be linked together passing information to each other throughout the battlespace. This unprecedented networking capability and this taking in "off-board" information make the Block 3F software very capable but also very complex.

ALIS Risk: The next version of ALIS, version 2.0.2, also remains a technical and schedule risk. This version of ALIS combines the management of F135 engine maintenance within ALIS and tracks all the life-limited parts on each and every F-35 aircraft. The development of these capabilities is proving to be more difficult to integrate than previously estimated. To address these difficulties, industry has added additional software expertise to its team, and we have set up and operate the ALIS ORE at Edwards Air Force Base in California to test ALIS in a more operationally relevant environment. Despite these efforts, ALIS 2.0.2 is approximately 4 months late to fielding, with the first fielding to occur in March 2017 at Nellis Air Force Base in Nevada.

SDD Discoveries / Deficiencies: Although solid progress is being made -- we are now past the 90 percent complete with all of SDD -- F-35 development is not without technical discoveries and deficiencies, which are common for a system that is still in development.

Over the course of testing during SDD, we have discovered and reported deficiencies; however, no development program can ever expect to correct every open deficiency. The F-35 program is committed to correcting all deficiencies that the Services and Partners deem necessary to fix. The Program has a disciplined, long-successful process of using Services' and Partners' inputs to rank and prioritize all deficiencies that alone or in combination need to be corrected. The Program then fixes those high priority deficiencies. The Program has planned for additional flight testing for any deficiencies that require further fix verification or for any new deficiencies that may be discovered during continued development. We are committed to providing a Block 3F capability that operationally is effective and suitable for the operational test force and the warfighter.

Currently there are 100 Category 1 (Must Fix) deficiencies, and of those, 25 have already been corrected and verified as fixed, 33 have been corrected but are awaiting a test to verify that they are fixed, 39 are in the process of being fixed, and 3 are still being investigated. The Program has a plan in place to fix, test and verify all Category 1 (Must Fix) and Category 2 (Significant Impact) deficiencies with upgraded software releases and physical modifications to the aircraft.

During F-35C flight test in December 2015, it was discovered the outer, folding portion of the wing has inadequate structural strength to support the loads induced by pylons with AIM-9X missiles during maneuvers that cause buffet. The Program is currently flight testing re-designed outer wings. Once the new design is verified to provide the require strength, the fix

will be implemented in production and retrofitted to existing aircraft by swapping existing outer wings with the re-designed ones. Overall 32 aircraft will require the modification and the effort is scheduled to begin in summer 2017.

Another deficiency the Program is solving involves excessive F-35C vertical oscillations during carrier launch. During a catapult launch the nose landing gear strut is compressed as the catapult initial pre-tension load pulls on the nose landing gear, with the hold back bar restraining the aircraft from further forward movement due to engine thrust. Upon release of the hold back bar, the nose landing gear strut unloads and vertically oscillates as the aircraft accelerates towards take-off. The oscillations are more severe during lighter aircraft weight launches. The Program will test a reduced release load hold back bar in February/March 2017 with anticipated evaluation by the Navy in spring 2017. Results of this testing and the Navy's evaluation will determine if further corrective action is required.

IV Initial Operational Test and Evaluation

Initial Operational Test and Evaluation (IOT&E) Entrance: There are a number of criteria required by the DOT&E that must be met before IOT&E can begin. These include the release of the final Block 3F aircraft capability, the release of ALIS 3.0, the release of a verified and validated Mission Data File (MDF), the readiness of 23 instrumented aircraft in a Block 3F production representative configuration (6 USAF A-models, 6 USMC B-models, 6 USN C-models, 3 UK B-models, and 2 Netherlands A-models), and functioning Air-to-Air Range Infrastructure 2 (AARI 2) capability on the test aircraft and ranges. Additionally, a verified, validated, and accredited F-35 simulator must be delivered approximately 4 months prior to

completion of the 13 month long IOT&E program. This simulator requirement will be met by the Joint Simulation Environment located at Naval Air Station Patuxent River in Maryland.

It is likely that by February 2018, the release of ALIS 3.0, the release of a verified and validated MDF, the modifications necessary to place all 23 aircraft into a production representative configuration will not be completed. However, a large subset of those entrance criteria to start IOT&E will be met by February 2018. It is possible, with DOT&E approval, to incrementally start IOT&E by March 2018. Starting IOT&E incrementally, earlier than waiting for all entrance criteria to be fully met is desirable for many reasons: First, obtaining earlier feedback from the OT community will enable the JPO and Industry to make corrections and fixes sooner, providing better capabilities to the warfighter. Second, delaying IOT&E will result in higher costs because IOT&E support will have to continue longer than planned. The JPO estimates that a 6 month delay in the start of IOT&E will cost an additional \$30 million. Finally, since F-35s will be produced at over 100+ airplanes per year during IOT&E, the sooner deficiencies are discovered the quicker they can be cut into production, saving the time and resources that would otherwise be needed to retrofit these jets if they were to be produced without the corrections.

Annual Director of Operational Test and Evaluation (DOT&E) Evaluation: On 10 January, the Office of the Secretary of Defense (OSD) DOT&E released the 2016 DOT&E report on the F-35 to Congress. The independent program review from the DOT&E is an annual occurrence, and the process was executed with unfettered access to information and with the full cooperation of the F-35 JPO. There were no surprises in the draft report reviewed by the JPO; all of the issues mentioned are well-known to the JPO, the U.S. Services, International Partners

and our Industry team. While not highlighted by the DOT&E report, among the 17 issues cited in the report, the F-35 Program fully concurs with 10 of them, partially concurs with 4, and defers to the USN and USMC regarding the other 3. The F-35 Program has a dedicated effort underway to resolve or otherwise mitigate them, as shown in the table below.

DOT&E Recommendation

1. The program should complete all necessary Block 3F baseline test points. If the program uses test data from previous testing or added complex test points to sign off some of these test points, the program must ensure the data are applicable and provide sufficient statistical confidence prior to deleting any underlying build-up test points.
2. In light of the fact that the program is unable to correct all open deficiencies prior to IOT&E, the program should assess and mitigate the cumulative effects of the many remaining SDD deficiencies on F-35 effectiveness and suitability, especially those deficiencies that, in combination or alone, may cause operational mission failures during IOT&E or in combat, prior to finalizing and fielding Block 3F. The program will need to add test points to troubleshoot and address deficiencies that are currently not resolved.
3. The program should consider developing another full version of Block 3F software to deliver to flight test in order to address more known deficiencies.

F-35 JPO Corrective Action

Concur: The program should complete all necessary test points. The F-35 program will continue to exercise the disciplined process of determining if test points are no longer required based on previous results. This process includes the OT, DT and operational user community. Any test point considered no longer required will be documented through the process.

Partially Concur: No acquisition program can ever expect to correct every open deficiency. The F-35 program is committed to correcting all deficiencies that the Services and Partners deem necessary to fix. The Program has a disciplined, long-successful process of using Services' and Partners' inputs to rank and prioritize all deficiencies that alone or in combination need to be corrected. The Program then fixes those high priority deficiencies. The Program has planned for additional flight testing for any deficiencies that require further fix verification or for any new deficiencies that may be discovered during continued development.

Partially Concur: The JPO partially concurs with the recommendation consistent with last year's response. The JPO software development strategy continuously evaluates known deficiencies for inclusion in future software releases. Whether additional software releases are necessary before the start of IOT&E will depend on the severity of the deficiencies, when they are discovered, and warfighter inputs on when and if they require fixes. Currently, the final version of software (3FR6) will have at least two additional updates (increments) to address deficiencies in the Feb to April 2017 timeframe.

DOT&E Recommendation

4. The program should ensure adequate resources remain available (personnel, labs, flight test aircraft) through the completion of IOT&E to develop, test, and verify corrections to deficiencies identified during flight testing.
5. The program should address the deficiency of excessive F-35C vertical oscillations during catapult launches within SDD to ensure catapult operations can be conducted safely during IOT&E and during operational carrier deployments.
6. The Program Office must immediately fund and expedite the contracting actions for the necessary hardware and software modifications to provide the necessary and adequate Block 3F mission data development capabilities for the USRL, including an adequate number of additional radio frequency signal generator channels and the other required hardware and software tools.
7. The program should address the JOTT-identified shortfalls in the USRL that prevent the lab from reacting to new threats and reprogramming mission data files consistent with the standards routinely achieved on legacy aircraft.
8. The program should correct deficiencies that are preventing completion of all of the TEMP-required Block 3F Weapons Delivery Accuracy (WDA) events and

F-35 JPO Corrective Action

Partially Concur: The JPO software development strategy continuously evaluates deficiencies for inclusion in future software releases. As part of the evaluation, the resources needed to support this work are continuously evaluated to ensure adequate resources are available as needed.

Concur: The JPO is already taking action, under the advice a NAVAIR-led Red Team. The program is planning field-based catapult testing of a SDD aircraft in February 2016 to assess: (a) standardized pilot guidance for use of cockpit restraints, (b) a corrected helmet magnetic map file that should reduce unintended movement of helmet display symbology during launch and (c) a reduced release load for the repeatable-release hold-back bar (RRHB) that will reduce the stored energy in the nose strut at the start of the launch. If successful, VFA-101 would return to carrier qualification trials in mid-2017 to assess these same changes. If further improvement is still required after making these changes, concepts have been developed for JPO to pursue longer-term solutions.

Concur: The hardware and software necessary to develop, test, and release Block 3F mission data files will be in place at the USRL by February 2017. Additionally, Industry has gone out on risk to begin this effort prior to contract award. The additional radio frequency signal generator channels are being aligned with the Follow-on Modernization upgrade.

Concur: The mission data file generation tool being delivered in February 2017 addresses many of the shortfalls identified. The remaining shortfalls will be addressed in subsequent USRL capability upgrades to fully satisfy JOTT and DOT&E intent.

Concur: Work is on-going to address all deficiencies that are preventing the completion of the final Block 3F WDA events. The current schedule has all WDA events completed by March 2017.

DOT&E Recommendation

ensure the events are completed prior to finishing SDD.

9. The program should ensure Block 3F is delivered with capability to engage moving targets, such as that provided by the GBU-49, that do not require lead-laser guidance.
10. The program should complete additional testing and analysis needed to determine the risk of pilots being harmed by the Transparency Removal System (which shatters the canopy first, allowing the seat and pilot to leave the aircraft) during ejections in other than ideal, stable conditions (such as after battle damage or during out-of-control situations). The program should complete these tests as soon as possible, with the new equipment, including the Gen III Lite helmet in a variety of off-nominal conditions, so that the Services can better assess risk associated with ejections under these "off-nominal" conditions.
11. The program needs to conduct an assessment to determine the extent to which the results of further durability testing with BH-1, the F-35B durability test article, are representative of production aircraft and, if necessary, procure another test article for the third life testing.
12. The Navy and the Program Office should investigate alternatives for determining the operational impact of an engine removal and install while conducting carrier air wing operations at sea.
13. The Navy and Marine Corps should conduct an analysis, such as an operational logistics footprint study, which simulates flight deck and hangar bay spotting (aircraft placement) with a full ACE onboard, using data from the DT-III ship trials to determine what the impact of an

F-35 JPO Corrective Action

Concur: JPO is working with the Service and Industry to integrate the GBU-49 on the F-35 by the end of CY2017.

Partially Concur: Off-nominal testing has been completed. The results were used to update the safety assessments which remained at a low risk and this has been shared with the Services. Upgrades to the ejection seat, currently in-work, or helmet would not impact performance of the Transparency Removal System.

Concur: JPO has conducted an engineering assessment, resulting in a recommendation for an additional article and test. The UK MOD has provided a formal request for an additional test, and a similar requirement is expected from NAVAIR in the near future. Preliminary planning and budgeting activities have been initiated.

Concur: Engine R&R has already been demonstrated for during sea trials for both the B and C models. If the Services require further testing or demonstrations, the JPO will support such events.

Defer: The JPO will defer to the U.S. Navy and USMC on this recommendation.

<u>DOT&E Recommendation</u>	<u>F-35 JPO Corrective Action</u>
engine removal and installation would be on integrated ship and ACE operations with a full ACE onboard.	
14. The program and the Navy should investigate if the heavy power module container should be redesigned for better usability at sea.	Concur: The power module container has been re-designed for better usability at sea and will be available for future deployments.
15. The program and the Navy should investigate potential options to improve ship-based communications bandwidth dedicated to ALIS connectivity off-ship, such as increasing the priority of ALIS transmissions, or reserving low-use times of the day for handling large volumes of ALIS message traffic.	Defer: The JPO will defer to the U.S. Navy on this recommendation.
16. The Navy should investigate any efficient, multi-use opportunities for F-35 support equipment (SE) such as using legacy SE on the F-35 or F-35 SE on legacy aircraft.	Concur: The Program already has in place a successful “multi-use” support equipment process where opportunities have already been harvested such as the use of a legacy lift for the engine power module container.
17. The Navy should investigate options for increasing the number of wall power outlets in CVN hangar bays to help facilitate simultaneous maintenance on multiple F-35Cs, or the ability to interconnect multiple pieces of support equipment from a single outlet to permit simultaneous operations.	Defer: The JPO will defer to the U.S. Navy on this recommendation.

V Follow-on-Modernization

Looking beyond the SDD program, the follow-on effort, known as FoM, is moving forward. The F-35 JPO will execute FoM as a continuation of the F-35 program with full transparency and reporting on cost, schedule and performance as if it were a new program. FY 2016 efforts included contracts for a Requirements Decomposition and System Functional Review effort for early Block 4 requirements. Additionally the Technical Refresh 3 (TR-3)

hardware strategy (new F-35 main computers and displays) has been identified, a suitable specification was developed and the TR-3 system design phase will be awarded to Lockheed Martin in the first half of 2017.

Efforts this year (2017) will include a Requirements Decomposition and Functional Allocation of Block 4.1 and completion of the System Functional Review this summer. A Planning and Systems Engineering Phase II contract award is planned for spring 2017, which will support a Preliminary Design Review for Block 4.1 prior to the major Engineering, Manufacturing and Development contract award in late 2018.

After a thorough analysis of the original F-22 and F/A-18 modernization strategies, the F-35 program will continue to heed lessons learned and will be fully transparent to the Congress by providing a separate modernization statement of work and contract, a separate modernization budget to be reported to the Congress, a separate cost reporting and earned value performance reporting system, an independent program cost estimate updated prior to contract award, and finally, rigorous, formal requirements oversight.

F-35 Dual Capable Aircraft continues to be aligned with and included in the initial increment of the Block 4 FoM effort. Detailed Risk Reduction activities have been completed to ensure that the F-35A is fully compatible with the B61-12 weapon. The JPO has begun initial planning for the Block 4 Nuclear Certification efforts in anticipation of beginning B61-12 integration on the Block 4.1 configured F-35A in 2018. The F-35 JPO is fully engaged with the USAF, Department of Energy, and strategic partners and is confident that this capability will be fielded and certified in time to meet specified need dates.

Block 4 planning for developmental and operational testing, to include the number of test

assets required, is in the early stages and seeks to successfully transition from a large scale air vehicle system testing to a more focused capability update(s) testing planned in modernization. The current focus is on planning for a sufficient and efficient level of test assets and infrastructure to fully support a planned 2 year update cycle. Further, the Program is identifying the modifications required by the development test fleet to accomplish FoM Block 4 testing.

VI Production

Production Delivery Performance: In 2016, the program delivered 46 aircraft, 7 short of the planned 53 aircraft. This includes 40 aircraft from the Fort Worth, Texas, Final Assembly and Check Out (FACO) facility and 6 aircraft from the Italian FACO in Cameri, Italy. In August of 2016, Lockheed Martin declared an issue with non-conforming insulation on the polyalphaolefin (PAO) cooling tubes in some F-35A wing fuel tanks. The subsequent investigation and repairs affected 42 production aircraft, and resulted in delays, limiting the production delivery to 46 aircraft from the planned 53 aircraft in 2016.

In 2017, the goal is to deliver a total of 66 aircraft, which includes carryover of the seven aircraft originally planned for delivery in 2016. Of those 66 aircraft, 61 aircraft will be delivered from the Fort Worth FACO, 3 aircraft from the Italian FACO, which includes their first “B” model produced, and the first 2 aircraft deliveries from the Japanese FACO in Nagoya, Japan.

F-35 LRIP Pricing: The price of F-35s continues to decline steadily Lot after Lot. For example, the price (including airframe, engine, and contractor fee) of a LRIP 9 F-35A aircraft is approximately 5.5 percent less than an LRIP 8 aircraft, a LRIP 9 F-35B aircraft is approximately 2.0 percent less than an LRIP 8 aircraft, and a LRIP 9 F-35C aircraft is approximately 2.6

percent more than an LRIP 8 aircraft. The F-35C increase is driven by the quantity negotiated dropping from four in LRIP 8 to two in LRIP 9.

We recently reached an agreement with the F-35 prime contractor for LRIP 10 marking the first time the price for an F-35A will be below \$100 million. The price for a LRIP 10 F-35A will be \$94.6 million, a 7.3 percent reduction from LRIP 9. The LRIP 10 prices for an F-35B (\$122.8 million) and F-35C (\$121.8 million) will also be lower than LRIP 9 prices by 6.7 percent and 7.9 percent, respectively.

Over the course of the LRIP contracts we have had a challenge on the timeliness of aircraft deliveries. However, over the past few years, even though production quantities have increased, we are seeing a dramatic reduction in the number of average days aircraft are being delivered late as shown in the table below.

LRIP	Average Days Late to Contract Deliveries
1	23
2	96
3	131
4	139
5	87
6	68
7	20
8	30

Late deliveries have jumped from an average of 20 to 30 days for the 34 aircraft in LRIP 8, mainly due to the PAO tube issue referenced earlier. The trend of fewer and fewer late deliveries is a positive development that the JPO and Industry will continue to improve upon in the coming years.

Production Block Buy / EOQ Contracting: The program has initiated a Block Buy/Economic Order Quantity (EOQ) contracting strategy for LRIPs 12, 13 and 14. This strategy gives the F-35 Partners and FMS customers the flexibility to procure all aircraft in a single procurement for LRIP 12 (FY 2018) or to procure aircraft and engines in a multiple lot format for LRIP 12 (FY 2018), LRIP 13 (FY 2019), and LRIP 14 (FY 2020). The U.S. Services will procure LRIP 12, 13 and 14 as single year procurements and will only request Congressional approval to award a single contract to procure material and equipment in EOQ for FY 2019 and FY 2020. There is no multi-year commitment for U.S. Services aircraft and engines; which will continue to be bought on an annual basis for LRIPs 12 - 14 (FY 2018 -2020) and preserves Congressional annual discretion. The estimated savings have been validated by an F-35 JPO cost estimate, an industry analysis study and an independent assessment conducted by RAND Corporation. Procuring approximately 445 aircraft with this Block Buy/EOQ strategy is estimated to save approximately \$2 billion compared to the LRIP 11 annual procurement price.

Block Buy savings are achieved by allowing contractors to utilize EOQ purchases, enabling suppliers down to the component level to maximize production economies of scale. Savings are also achieved due to learning curve improvements on production lines and other Government and Industry cost reduction initiatives which may not have been otherwise executed, if not for a stable multiple year requirement to procure parts.

The risk of the Block Buy/EOQ strategy for Partner and FMS customers for Lots 12, 13 and 14 is considered low because the design of the weapon system will be stable during this period of time. All F-35 models (A, B and C) have already completed second life (8,000 hours full life) durability testing. Additionally, 98 percent of all hardware and subsystems

qualifications are completed, and the full Block 3F capability will begin delivery near the end of Lot 9, well before Lots 12, 13 and 14 are delivered. For the U.S. Services and Congress, the risk is even lower because the only commitment is to purchase 2 years-worth of parts in a single EOQ procurement, (FY 2019 and FY 2020).

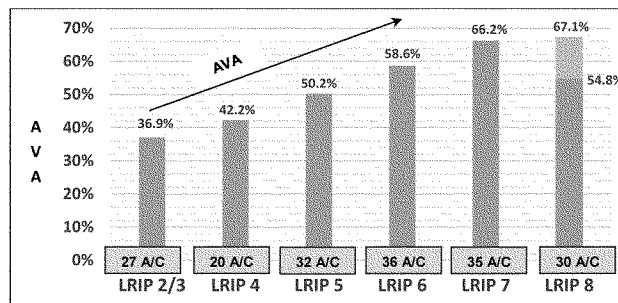
Engine Production: In 2016, the Program completed contractual actions with Pratt & Whitney on LRIP 9 & 10 for the F135 propulsion system. The F-35A/F-35C propulsion system reduced 3.4 percent from the previously negotiated LRIP 8 price to the negotiated LRIP 10 price. The F-35B propulsion system (including lift systems) reduced 6.4 percent from the previously negotiated LRIP 8 price to the LRIP 10 price. Pratt & Whitney has delivered approximately 50 percent of the 67 production propulsion systems in LRIP 9 and is currently slightly ahead of contract delivery requirements. Pratt & Whitney continues efforts to improve quality surveillance within its manufacturing processes resulting in a 35 percent reduction in quality escapes during 2016; however, improvements at the vendor level are needed to identify and eliminate quality non-conformances which have interrupted engine deliveries. For 2017, Pratt & Whitney remains focused on increasing capacity at existing suppliers and qualifying second and third sources as needed to meet production ramp.

VII Sustainment

As of the beginning of February 2017, there are 216 F-35s operating at 11 sites. Luke Air Force Base in Arizona is the main training base for the USAF, many Partners and our FMS customers. Marine Corps Air Station (MCAS) Beaufort in South Carolina is the main F-35B training base for the USMC and United Kingdom. Additionally, Italy will utilize MCAS Beaufort when it receives its F-35Bs from the Italian FACO. Eglin Air Force Base in Florida is

the main training base for the USN's F-35C until Naval Air Station (NAS) Lemoore in California is stood up. All F-35 maintainers also get their initial maintenance training at Eglin Air Force Base. In the next 4 years, we will add another 17 operating bases to the F-35 enterprise across all 3 regions of North America, the Pacific and Europe.

Aircraft availability rates remained steady in 2016 at 50 percent for the A-model, 47 percent for the B-model and 59 percent for the C-model. This continues to be a focus area for the Program and various program initiatives are being executed to improve overall weapon system availability. A disciplined Reliability & Maintainability (R&M) program, improved maintenance procedures and manuals, continued improvement in the ALIS, better forecasting of spares requirements, improved repair turnaround times from suppliers and incorporation of aircraft design improvements are having a positive effect, but at a slower rate than desired. However, newer aircraft are showing significantly better R&M Availability Rates when compared to older lot aircraft. The chart below shows the combined (F-35 A, B and C-model) Aircraft Availability (Air Vehicle Availability – AVA) rates for each production lot. The F-35A LRIP 8 rate (54.8 percent) was impacted by the F-35A Fuel Systems modifications and the PAO insulation corrections. The LRIP 8 AVA rate would have been 67.1 percent if we did not experience the PAO insulation issue.



In 2016, the Program continued its efforts toward the establishment of the Global Sustainment posture across Europe, Asia-Pacific, and North America. Last fall, the Program made regional Maintenance, Repair, Overhaul, and Upgrade (MRO&U) selections for repairing 65 out of 774 repairable components on the F-35. These initial component repair capabilities when combined with F-35 airframe and engine heavy-level maintenance will provide all customers including the U.S. Services the ability to maintain and repair their aircraft globally.

The F-35 JPO will assign the remaining 709 components over the next 2 to 3 years and in October 2016 released a request for information for F-35 warehousing and support equipment repairs. DoD will assign to the F-35 Partners and FMS customers repair capabilities such as wheels and brakes, electrical and hydraulic systems, maintenance of support equipment, and warehousing for the global supply chain. These same capabilities either currently exist or are being developed at the U.S. Services' depots in the U.S. in accordance with current U.S. law.

VIII Delivering Combat Capability

In support of meeting the USAF's IOC, the 388th Fighter Wing at Hill Air Force Base in Utah deployed its F-35As to Mountain Home Air Force Base in Idaho for a two-week exercise last summer. The unit successfully flew all 88 of its planned sorties and achieved 94 percent direct hits with the weapons it expended. F-35 pilots executed multiple air-to-air and air-to-ground engagements with threats and the F-35 proved to be extremely survivable in both environments.

The USMC took its F-35Bs to Red Flag last summer. The F-35 flew 67 of its 70 scheduled sorties and proved itself as a dominant weapon system. During the first few weeks of that exercise, F-35s were not only NOT shot down but were not targeted. They also hit all their targets. And by the end of the exercise, F-35s were being used as Intelligence Surveillance

Reconnaissance platforms above the battlespace to connect with fourth-generation airplanes to improve their survivability.

The USMC also conducted a live fire weapons exercise at Eglin Air Force Base in Florida last summer. The main highlight of that was one of the pilots simultaneously laser-guided a GBU-12 bomb at the same time he was engaging an air-to-air target with an AIM-120 radar missile. Both were direct hits. This is something that no fourth-generation fighter can accomplish.

Additionally, the USMC conducted a live fire test in conjunction with the Naval Integrated Fire Control-Counter Air family of systems last September. An F-35B from Marine Operational Test and Evaluation Squadron 1 (VMX-1) at Edwards Air Force Base in California participated in Live Fire Test at White Sands Missile Range in New Mexico. During this demonstration an F-35B detected, tracked and targeted a low flying MQM-170E drone aircraft and passed this information via the aircraft's Multi-functional Advanced Data Link (MADL) to the Aegis combat system aboard the USS Desert Ship (LLS-1). The USS Desert Ship then fired a Standard Missile-6 missile from "over-the-horizon" and shot down the drone. This demonstrated the interoperability of the F-35 with the Navy's Integrated Fire Control system and how the F-35 can make other linked platforms in the battlespace smarter and more survivable.

To round out the year, VMX-1 also deployed aboard the USS AMERICA in conjunction with the DT ship event in October. The Marines not only assisted in DT execution with manpower and resources, but also executed a "Lightning Carrier" concept demo during the final 4 days of the at-sea period during which 12 F-35B were embarked on the ship and conducted Suppression of Enemy Air Defenses Strike missions followed by an assault support escort mission with 2 MV-22s, 1 UH-1 and 1 AH-1. The operation successfully represented the largest

number of F-35s aboard a ship to date.

In January of this year, the USMC also deployed 10 F-35Bs from its Marine Fighter Attack Squadron (VFMA) 121 from Marine Corps Air Station (MCAS) in Yuma Arizona to MCAS Iwakuni, Japan. The F-35 Lightning II JPO applauds the Marines for this accomplishment and will continue to support them as they deploy more aircraft to MCAS Iwakuni later this year and ready for an operational shipboard deployment next year.

IX International Partner and FMS Participants

International participation on the program with eight Partners and three FMS customers remains strong. Over the past ten months, aircraft deliveries to our United Kingdom, Italy, and Norway Partners have continued, while FMS customers Israel and Japan received their first aircraft deliveries. Two significant milestones for Italy included the delivery of its first jet completed at the Italian Final Assembly and Check-Out (FACO) facility in Cameri, Italy and also the first aircraft arrival into its operational base located in Amendola, Italy. Notably, Israel also achieved first aircraft arrival into its operational base in Nevatim, Israel and it has identified a requirement for an additional 17 aircraft from an existing fleet of 33. Also, the Japanese aircraft FACO in Nagoya and engine FACO in Mizuho are both on track to deliver their first respective Japanese aircraft and engine later this year.

The international pilot and maintainer training taking place at Luke Air Force Base in Arizona continues to expand with the arrival of the first Japanese aircraft in late November, while the training taking place between the USMC and the British Royal Air Force at MCAS Beaufort in South Carolina, continues to pay dividends for both services.

This past May, the two Dutch aircraft that are part of the DT fleet at Edwards Air Force Base in California completed their first deployment to the Netherlands, where they conducted aerial and ground environmental noise surveys, performed flights over the North Sea range, and also appeared at the Netherlands' Open Days, the largest air show held annually in the Netherlands. Following their three-week deployment, the jets returned to the U.S., and the resulting noise surveys showed there were no noticeable differences between the F-35 and F-16 to the Dutch communities surrounding their airbases.

In early June, the Danish Parliament approved its government's recommendation to acquire 27 F-35As, and Denmark became the 7th partner nation and 11th nation overall to buy the F-35. Also that same month, F-35Bs landed for the first time in the United Kingdom. The United Kingdom F-35B was the first to touch down and was followed shortly afterwards by two other F-35Bs from the USMC and two USAF F-35As. The F-35s were in the United Kingdom to support the Royal International Air Tattoo and the Farnborough Air Show taking place in early July. More importantly, this was a deployment for the United Kingdom, USMC and USAF where they sustained and maintained the aircraft, generated sorties, and ultimately provided lessons learned on future F-35 operations.

In September, Turkey held the 65 percent Design Review for its first Main Operating Base which will be located in Malatya, Turkey. This review is a major milestone on the way to ensuring Turkey's infrastructure is ready for aircraft arrival in 2019. In late October, the Turkey Defense Industrial Executive Committee met and approved the Block Buy for 24 aircraft over 3 contract years.

Following flight testing and the USAF's recommendation, Australia authorized aerial refueling operations between its KC-30A tanker aircraft and F-35As in January. Preparations at Australia's first operating base, Royal Australian Air Force Base in Williamstown continue as construction of hangers, training centers, and information support centers remain on schedule. And, finally, the debut of Australia's F-35As at the 2017 Avalon International Airshow is on track and scheduled for March 2017 near Melbourne.

November was a significant month for South Korea as it was one of the countries assigned initial F-35 component repair capability. In addition, the first six Korean aircraft were awarded as part of the recent Lot 10 aircraft contract, with expected delivery in 2018.

Over the past year, the JPO has worked closely with the U.S. Defense Security Cooperation Agency to promptly and thoroughly answer all questions provided by the Canadian government in support of its fighter replacement analysis. Further, the JPO has continued to work with potential FMS customers, including Belgium, Finland, and Spain, responding to all requests for information and other official inquiries.

X Conclusion

In summary, the F-35 fleet is rapidly expanding and F-35s are now flying in the U.S., Japan, Italy and Israel. The F-35 Program is nearing the completion of development within the cost and schedule boundaries laid in during the 2011 Rebaseline. The Program is also continuing to ramp up production and building the global sustainment enterprise. The Program's main focus areas include:

- Completing development within the time and resources we have;
- Delivering the full Block 3F capabilities;
- Smoothly transitioning from development to Follow-on-Modernization;

- Completing the production ramp-up while continuing to improve quality and the delivery schedule;
- Continuing to grow the global sustainment enterprise, and;
- Improving the fielded fleet's performance

As always, our number one overarching priority is to continue to drive cost out of all aspects of the F-35 Program, making it more affordable for all our customers.

As development continues we expect new technical discoveries will occur; however, as we have demonstrated in the past, we believe the combined Government/Industry team has the ability to resolve any future issues. My JPO team's commitment to overcoming these and any future challenges is unwavering and we will deliver the F-35's full capability to our customers. We will continue executing with integrity, discipline, transparency and accountability, holding ourselves accountable for the outcomes on this Program. Our team recognizes the great responsibility we have been given to provide the foundation of future U.S. and Allied fighter capability for decades to come. We also recognize that someday your sons and daughters, or grandsons and granddaughters may take this aircraft into harm's way to defend our freedom and way of life. It is a responsibility we never forget.

Thank you again for this opportunity to discuss the F-35 Program. We look forward to answering any questions you have.

LIEUTENANT GENERAL CHRISTOPHER C. BOGDAN

Program Executive Officer for the F-35 Lightning II Joint Program Office

Lt. Gen. Christopher C. Bogdan is the Program Executive Officer for the F-35 Lightning II Joint Program Office in Arlington, Va. The F-35 Lightning II Joint Program Office is the Department of Defense's agency responsible for developing and acquiring the F-35A/B/C, the next-generation strike aircraft weapon system for the Navy, Air Force, Marines, and many allied nations.

General Bogdan was commissioned in 1983 from the U.S. Air Force Academy. He has served as an operational pilot, test pilot, staff officer, executive officer, acquisition program manager, and program director. He is a command pilot and experimental test pilot with more than 3,200 flying hours in more than 35 aircraft types, including the KC-135, FB-111A, B-2 and F-16. He has commanded at the squadron and group levels, and served as the executive officer to the Commander, Electronic Systems Center, and to the Commander, Air Force Materiel Command.

General Bogdan also served as the Program Executive Officer for the KC-46 Tanker Modernization Directorate, Wright-Patterson AFB, Ohio.

Prior to his current assignment, General Bogdan was Deputy Program Executive Officer for the F-35 Lightning II Joint Program Office in Arlington, Va.

EDUCATION

1983 Distinguished graduate, Bachelor of Science degree in aeronautical engineering, U.S. Air Force Academy, Colorado Springs, Colo.

1989 Distinguished graduate, Squadron Officer School, Maxwell AFB, Ala.

1990 Distinguished graduate, USAF Test Pilot School, Edwards AFB, Calif.

1994 Master of Science degree in engineering management, with distinction, California State University, Northridge

1995 Distinguished graduate, Air Command and Staff College, Maxwell AFB, Ala.

1998 Air War College, by correspondence

2000 Distinguished graduate, Master of Science degree in national resource strategy, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C.

2005 Advanced Program Managers Course, Defense Systems Management College, Fort Belvoir, Va.

2006 U.S. Air Force Senior Leadership Course, Center for Creative Leadership, Greensboro, N.C.

2007 National Security Management Course, Maxwell School of Citizenship, Syracuse University, N.Y.

2013 Cyber Operations Executive Course, Air University, Maxwell AFB, Ala.

ASSIGNMENTS

1. July 1983 - June 1984, student, undergraduate pilot training, Reese AFB, Texas

2. June 1984 - November 1984, pilot, KC-135 crew training, Castle AFB, Calif.

3. November 1984 - March 1987, pilot, KC-135A and T-37A, 509th Air Refueling Squadron, Pease AFB, N.H.

4. March 1987 - April 1988, pilot, FB-111A Crew Training, Plattsburgh AFB, NY

5. April 1988 - June 1990, FB-111A instructor pilot, 393rd Bomb Squadron, Pease AFB, N.H.

6. June 1990 - June 1991, student, Class 90B, U.S. Air Force Test Pilot School, Edwards AFB, Calif.

7. June 1991 - December 1991, experimental test pilot, 6512th Test Operations Squadron, Edwards AFB, Calif.

8. December 1991 - June 1995, B-2 experimental test pilot, B-2 Chief of Training, B-2 Test Program Manager and Assistant Deputy for Operations, 420th Flight Test Squadron, Edwards

AFB, Calif.

9. June 1995 - June 1996, student, Air Command and Staff College, Maxwell AFB, Ala.
10. June 1996 - May 1997, Program Manager, Theater Missile Defense Systems, Special Projects Program Office, Electronic Systems Center, Hanscom AFB, Mass.
11. May 1997 - June 1999, executive officer to the Commander, Electronic Systems Center, Hanscom AFB, Mass.
12. June 1999 - June 2000, student, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C.
13. June 2000 - May 2001, Deputy Commander, 412th Operations Group, Edwards AFB, Calif.
14. May 2001 - July 2002, Commander, 645th Materiel Squadron, Wright-Patterson AFB, Ohio
15. July 2002 - September 2003, executive officer to the Commander, Air Force Materiel Command, Wright-Patterson AFB, Ohio
16. September 2003 - June 2005, Commander, Special Operations Forces Systems Group, Wright-Patterson AFB, Ohio
17. June 2005 - May 2006, Deputy Director, Directorate of Global Power, Office of the Assistant Secretary of the Air Force for Acquisition, Headquarters U.S. Air Force, Washington, D.C.
18. May 2006 - May 2008, Senior Military Assistant to the Deputy Under Secretary of Defense for Acquisition and Technology, Office of the Secretary of Defense, Washington, D.C.
19. May 2008 - May 2009, Senior Military Assistant to the Under Secretary of Defense for Acquisition, Technology and Logistics, Office of the Secretary of Defense, Washington, D.C.
20. June 2009 - July 2012, KC-46 Program Executive Officer and Program Director, KC-46 Tanker Modernization Directorate, Aeronautical Systems Center, Wright-Patterson AFB, Ohio
21. July 2012 - December 2012, Deputy Program Executive Officer for the F-35 Lightning II Joint Program Office, Arlington, Va.
22. December 2012 - present, Program Executive Officer for the F-35 Lightning II Joint Program Office, Arlington, Va.

SUMMARY OF JOINT ASSIGNMENTS

May 2006 - May 2009, Senior Military Assistant to Deputy Under Secretary of Defense for Acquisition and Technology, and Senior Military Assistant to the Under Secretary of Defense for Acquisition, Technology and Logistics, Office of the Secretary of Defense, Washington, D.C.

FLIGHT INFORMATION

Ratings: Command pilot, parachutist

Flight hours: More than 3,200

Aircraft flown: KC-135A/E, FB-111A, F-16A/B, B-2A, T-37A, T-38, B707, RC-135, T-39A and 25 other aircraft types

MAJOR AWARDS AND DECORATIONS

Defense Superior Service Medal

Legion of Merit

Meritorious Service Medal with six oak leaf clusters

Air Force Commendation Medal

Air Force Aerial Achievement Medal

Air Force Achievement Medal

OTHER ACHIEVEMENTS

Outstanding Cadet in Aeronautical Engineering, U.S. Air Force Academy

British Marshall Scholarship National Finalist

Rhodes Scholar Candidate, U.S. Air Force Academy

Distinguished graduate, KC-135 Training

Outstanding graduate, FB-111A Flight Instructor Course

Company Grade Officer of the Year, Air Force Flight Test Center

PROFESSIONAL CERTIFICATIONS

Program Management, Level III, Acquisition Professional Development Program
Test and Evaluation, Level III, APDP

EFFECTIVE DATES OF PROMOTION

Second Lieutenant June 1, 1983
First Lieutenant June 1, 1985
Captain June 1, 1987
Major March 1, 1995
Lieutenant Colonel Sept. 1, 1998
Colonel Aug. 1, 2002
Brigadier General Dec. 9, 2008
Major General Nov. 18, 2011
Lieutenant General Dec. 6, 2012

NOT FOR PUBLICATION UNTIL RELEASED BY THE
HOUSE ARMED SERVICES COMMITTEE
TACTICAL AIR AND LAND FORCES SUBCOMMITTEE

STATEMENT
OF
LIEUTENANT GENERAL JON DAVIS
UNITED STATES MARINE CORPS
DEPUTY COMMANDANT FOR AVIATION
BEFORE THE
HOUSE ARMED SERVICES SUBCOMMITTEE ON
TACTICAL AIR AND LAND FORCES
ON
F-35 LIGHTNING II PROGRAM
16 FEBRUARY 2017
RAYBURN HOUSE OFFICE BUILDING

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HOUSE ARMED SERVICES COMMITTEE
TACTICAL AIR AND LAND FORCES SUBCOMMITTEE

Lieutenant General Jon Davis
Deputy Commandant for Aviation

Lieutenant General Jon M. DavisLieutenant General Jon M. Davis assumed his current position as the Deputy Commandant for Aviation, Headquarters Marine Corps in July 2014.

Commissioned in May 1980 through the PLC Program, received his wings in September of 1982, and was selected to fly the AV-8A Harrier. He served in VMA-231, as an Airframes Division Officer and Instructor in VMAT-203, as WTI and Operations Officer in VMA-223, as a RAF exchange pilot with 3(F) squadron in Gutersloh Germany, AND as a MAWTS-1 instructor in Yuma, AZ. From 1998 to 2000, he commanded VMA-223. After completing the Executive Helicopter Familiarization Course at HT-18 in Pensacola, he served as Executive Officer and then Commanding Officer of MAWTS-1 from 2003 to 2006. From 2006 to 2008, he served as the Deputy Commander Joint Functional Component Command -- Network Warfare at Fort Meade, Maryland. He commanded the 2nd Marine Aircraft Wing from July 2010 to May 2012. From May 2012 to June 2014, he served as the Deputy Commander, United States Cyber Command.

His staff billets include the 31st Commandant's Staff Group, the Junior Military Assistant to the Deputy Secretary of Defense, Assistant Operations Officer, then Officer in Charge of the 3d Marine Aircraft Wing Red Team in Iraq. He served as the Deputy Assistant Commandant for Aviation from 2008 to 2010.

In the course of his career he has flown over 4,500 mishap free hours in primarily the AV-8, but also in the F-5, FA-18, and every type model series tilt-rotor, rotary winged and air-refueler in the USMC inventory plus general and experimental aviation aircraft.

LtGen Davis graduated with honors from The Basic School and was a Distinguished Graduate of the Marine Corps Command and Staff College. He is a graduate of the Tactical Air Control Party Course, Amphibious Warfare School, Marine Aviation Weapons and Tactics Instructor Course (WTI), The School of Advanced Warfighting (SAW), and Johns Hopkins School of Advanced International Studies (SAIS). He holds a Bachelor of Science from Allegheny College, a Master of Science from Marine Corps University and a Master of International Public Policy from Johns Hopkins.

Chairman Turner, Ranking Member Tsongas, distinguished members of the House Armed Services Subcommittee on Tactical Air and Land Forces, and other distinguished members, thank you for your continued support. We appreciate the opportunity to testify on the F-35 Lightning II Program.

I had the opportunity to meet with many of your committee staff in January to discuss the Marine Corps Aviation Plan for FY17. As I'm sure you are aware, the F-35 remains a top aviation acquisition priority for the Marine Corps; we can't get into this aircraft fast enough. Along with sustainment and digital interoperability, modernization is one of three key lines of effort facilitating our transition to a fleet of 5th Generation Marine Tactical Aircraft (TACAIR). The Marine Corps declared F-35B initial operational capability (IOC) in July of 2015, five months ahead of the December threshold date. The aircraft is currently tracking to reach its full program-of-record operational capability (Block 3F) in the fourth quarter of calendar year 2017, and the full transition from legacy to F-35 will complete with the Marine Corps' transition of our second reserve squadron in 2031.

Additionally, thanks to the support of Congress, as of January, 2017, the F-35B is now permanently stationed at Marine Corps Air Station Iwakuni, Japan, with Marine Fighter Attack Squadron 121, at MCAS Yuma, AZ with VMFA-211, and at Beaufort, SC, with VMFAT-501, which is the training squadron with USMC, RAF and Royal Navy conversion pilots and five ab initio pilots – five Marine Corps Lieutenants who came to the F-35 directly from the training command. To date, the Marine Corps has accepted 50 F-35B aircraft. Ten of those F-35Bs are now forward-deployed with VMFA-121 in Japan. VMFA-121 will have their full complement of 16 aircraft by this summer and, by the end of this year, they will fill both the 31st Marine Expeditionary Unit (MEU) requirement and the land-based requirements within PACOM. The Marine Corps will reach full operational capability with 16 F-35B squadrons, 4 F-35C squadrons, and 2 F-35B training or fleet replacement squadrons (FRS). It is

important to note that both the F-35Bs and F-35Cs are required to fulfill the Marine Corps' operational plan and Marine Air Ground Task Force (MAGTF) requirements.

Additional events on the horizon for the F-35 include:

- VMFA-211 supporting a West Coast MEU in the summer of 2018.
- VMFA-122 transitioning from F/A-18 to F-35B in FY18 and relocating to MAG-13.
- West coast MEUs are sourced solely with F-35B by end of FY19.
- In FY19, VMFA-314 will be the first Marine Corps squadron to transition to the F-35C.

While VMFA-121's movement was not the first time TACAIR aircraft have been re-deployed across the Pacific, it is noteworthy that for the duration of the transit, all aircraft remained operational and in an "up" status. That is not usually the case with large movements like this for a brand new aircraft. Additionally, this redeployment provided valuable lessons-learned as we move forward with the program. For instance, the northern route we took was meant to reduce the number of times the aircraft were required to plug for air-to-air refueling. We have since learned that the fuel models are overly-conservative. Our movement generated data that will be used by the JPO to increase the model's accuracy. In the end it will benefit all three variants of the F-35 to be leveraged by the Marine Corps, Air Force and Navy.

From the operator's perspective the F-35's performance is unmatched. Joint Strike Fighters have participated in exercises such as Red Flag, Agile Lightning and our Weapons and Tactics Instructor Course or WTIC. At Red Flag, the Marine F-35Bs were called game changing and decisive by Gen Goldfien – the USAF Chief of Staff. We have operated the aircraft from austere sites, like the 29 Palms Strategic Expeditionary Landing Field. We have also conducted shipboard flights aboard L-Class amphibious ships – to include deploying 12 F-35Bs to the USS AMERICA in a Lightning Carrier Demonstration of

capability. Throughout these large-scale tactical exercises and regardless of the location, the aircraft has proven its worth across all assigned mission sets.

The feedback we've received from Red Flag instructors is that, "The F-35B is doing things they have never seen accomplished at Red Flag." At WTI, the contributions of the F-35 immeasurably enhanced the effectiveness of the Marine Air Ground Task Force, most notably through increased lethality and battlespace awareness. As a result, we have recently seen an increased demand for F-35 participation in our legacy fighter exercises because the 5th generation capabilities that the Joint Strike Fighter brings to the mission increase the synergy, awareness, lethality and survivability of the entire force. To be honest with you – nobody wants to fight us now that we've got the F-35.

But the truly impressive feedback comes from our FRS where we have just begun training our initial accession pilots. The unanimous view of my FRS flight instructors is that these pilots, flying a tactical aircraft for the first time in their careers, are performing at or above the level of my legacy pilots who are two to three years into their first fleet tour. This increased capability can be directly attributed to the optimized systems of the F-35.

I offer those examples and anecdotes as evidence of not only the aircraft's contribution to the MAGTF, but also our pilots' ability to optimize this weapons system based on its capabilities. This jet is incredibly capable in its 5th generation day one configuration – but is unique in that we can install pylons on the bird and transition from a stealth strike fighter – to a 5th generation bomb truck – delivering up to 14,000 pounds of ordnance on the F-35B (3000 pounds more than my legacy Hornets) and 18,000 pounds of ordnance on the F-35C from internal and external stores. When we need to go back to a full stealth configuration – we have our maintainers take off the pylons. There is no aircraft in the world that can do that. The flexibility of the F-35B means it can sortie from short deck amphibious ships and small carriers like the Queen Elizabeth, and from short expeditionary airfields like our organic Marine

Wing Support Squadrons (MWSSs) build – and bring the incredible capabilities this jet delivers. The F-35C provides the Marine Corps with the exact same systems capabilities and allows us to employ the aircraft from forward deployed airfields or from US Navy carrier large decks in support of Joint or MAGTF operations. I remain convinced that we are buying the right aircraft and the right numbers of F-35B and F-35C, particularly as the F-35 continues to receive its planned follow-on modernization upgrades.

The F-35B is tracking for completion of the System Development Demonstration (SDD) in February 2018. The JPO is expecting an initial release of the 3F software this summer and a subsequent release in spring 2018. The program is meeting the services' requirements in SDD, and we expect the F-35B to gain full weapons and envelope defined for SDD prior to our Marine Expeditionary Unit deployments in 2018. We are actively identifying and correcting deficiencies discovered throughout testing and prioritizing resources to ensure the final release of 3F will provide the best multi-role fighter aircraft capability in the world.

There is some inherent risk in our timeline as it pertains to discoveries of deficiencies. However, to date none of these deficiencies are expected to delay SDD or reduce the capability of the aircraft. The largest risk to the timeline is associated with the corresponding 3F Mission Data Files (MDFs) which are required prior to updating the aircraft to the 3F software. This file is currently projected to be complete in the summer of 2018.

Looking at the future of the aircraft, we are satisfied with the Block 4 capabilities and are confident that our warfighting needs will be met. However, it is essential that Block 4 is fully funded in order to ensure our capabilities remain years ahead of the near-peer threat and allow for continued advancement to follow-on blocks. The capabilities being delivered in Blocks 4.1 and 4.2 have progressed through Systems Requirements Review and will move to phase 2 contracts on or around April of 2017.

Regarding the readiness of the Autonomic Logistics Information System (ALIS), the Marine Corps has demonstrated the ALIS system's ability to deploy and support a full range of military operations in forward locations. It is true that the system will continue to evolve, but in the configuration now fielded, we have proven its capability both on the LHD and in the field at our expeditionary landing field in 29 Palms.

The bottom line is this: the F-35 is the most capable aircraft in our fleet and we simply cannot transition into this aircraft fast enough. The Marine Corps owns the oldest TACAIR fleet in the entire DoD; the average age of Marine Corps TACAIR is 22 years. Our fleet of Harriers, Hornets and Prowlers – while proven – is exhausted. F-35B ramp for PB17 has us at 16, 20, 20, 20, 21 across the FYDP for a total acquisition of 97 aircraft. However, we will explore options to increase this procurement ramp based upon our desire to accomplish three things:

- First, get us out of legacy platforms faster, improving both combat effectiveness and overall TACAIR readiness;
- Second, by possibly accelerating procurement, we estimate the Department could achieve a net savings of up to \$1.2 billion dollars in procurement spending;
- Finally, by modernizing to one type of aircraft more quickly, we could eliminate a three-fold redundancy in manpower, operating materiel, support services, training, maintenance competencies, and aircraft upgrades.

Conclusion:

I will conclude by reemphasizing that Marine aviation, particularly our TACAIR assets, is in a readiness crisis. We do not have the number of aircraft that we need to fulfill our operational commitments – to be your “force is readiness” as mandated by Congress. Our readiness recovery lies in

recapitalization of our assets. We must continue to transition out of our legacy aircraft and into this new aircraft *as fast as we can afford to buy them.*

Mr. Chairman, distinguished committee members, we appreciate your continued support of our Aviation programs and we look forward to answering all of your questions.

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THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

STATEMENT OF
REAR ADMIRAL D. H. MILLER III
DIRECTOR, AIR WARFARE
CHIEF OF NAVAL OPERATIONS
BEFORE THE
TACTICAL AIR AND LAND FORCES SUBCOMMITTEE
OF THE
HOUSE ARMED SERVICES COMMITTEE
ON
THE NAVY'S F-35C PROGRAM

February 16, 2017

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SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

Introduction

Chairman Turner, Ranking Member Tsongas and distinguished Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss how the Navy's F-35C, with fifth generation capabilities and fully integrated into our carrier Air Wings, will meet warfighting needs. The F-35C will form the backbone of Navy air combat superiority for decades to come complementing the tactical fighter fleet with a dominant, multirole, fifth-generation aircraft capable of projecting U.S. power and deterring potential adversaries.

The Carrier Air Wing of the future must rely on the capacity and capabilities of both fourth and fifth-generation aircraft. The F-35C provides unique capabilities that cannot be matched by modernizing fourth-generation aircraft. Stealth technology and advanced integrated systems enable the F-35C to counter rapidly evolving air-to-air and surface-to-air threats. Fifth-generation advancements shift focus from kinematics to information collection and dissemination in the real-time battle space, enabling us to break enemy kill chains while facilitating our own. Coupled with the proven capabilities and capacity of a continually improving and relevant Carrier Air Wing, the F-35C greatly enhances a Carrier Strike Group's battle space awareness, lethality and survivability to prevail in a high-end conflict.

The Fiscal Year (FY) 2017 President's Budget (PB-17) supports the F-35C procurement to complete System Development and Demonstration (SDD), Initial Operations Test and Evaluation (IOT&E), Initial Operational Capability (IOC) and to transition squadrons on a timeline that supports the first operational deployment on USS CARL VINSON (CVN 70) in FY 2021. The Navy also has a robust sustainment plan that supports operating this new aircraft and properly training maintenance crews and Carrier Air Wing aviators.

Continuous maintenance and modernization of both fourth and fifth-generation aircraft is critical to pace the rapidly evolving threat. Readiness recovery remains a key concern as the fiscally constrained environment has challenged our ability to sustain current strike fighter inventory. Investing in new aircraft and capabilities while ensuring adequate levels of readiness are both necessary to support current and enduring Naval Aviation requirements. To this end, Follow-on Modernization (FoM) and weapons integration for the F-35C are critical aspects of the entire F-35 program.

Ultimately, with F-35C integrated and interoperable in the Carrier Air Wing, the Carrier Strike Group of the future will be more lethal, survivable and able to accomplish the entire spectrum of mission sets to include immediate response to high-end threats. The Navy remains dedicated to a capabilities-focused approach as we evolve the Carrier Air Wing and the Carrier Strike Group of the future.

Operator's Perspective

Operations, exercises and milestones achieved over a four-year period at Eglin Air Force Base in Florida, Naval Air Station Lemoore in California and the U.S. Navy's Operational Test Squadron at Edwards Air Force Base in California demonstrate the program is on a positive trajectory. Early assessment of fourth and fifth-generation integration continues to indicate there will be improved survivability and lethality across all Carrier Air Wing assets against modern threats, especially after the full warfighting capability in Block 3F is delivered.

Progress has been made in the tactical integration of fourth and fifth-generation fighters. Further development is ongoing and continuous to include integrating F-35C into each class at the U.S. Navy Fighter Weapons School (TOPGUN). Fleet pilots using Delta Flight Path, the aircraft's precision landing mode, are experiencing enormous gains in safety, efficiency and

effectiveness. Last month, the first aircraft arrived at Naval Air Station Lemoore for the stand-up of the second F-35C site with introduction of the aircraft to the operational fleet coming in the near future.

System Development and Demonstration (SDD)

SDD delivers the full Block 3F capability to the warfighter and is a prerequisite to commencing IOT&E. F-35C IOC is defined by completion of IOT&E and one Block 3F F-35C squadron capable of deploying onboard an aircraft carrier for extended operations. The IOC definition also includes the requirement to properly man, train and equip required squadron personnel. IOC is therefore event driven and is directly impacted by IOT&E schedule. The Navy is pursuing selective testing when assets and capabilities are available in order to efficiently accomplish portions of the Test and Evaluation Master Plan.

The Navy is actively engaged to resolve SDD schedule risk. This includes correcting a weapons station overloading condition identified in early weapons carriage testing in order to carry and employ the AIM-9X within the full envelope of the aircraft. It also includes continued progress on catapult ride quality for aviators (also referred to as Nz oscillations) while launching from the aircraft carrier. Additionally, the Helmet Mounted Display system has posed a problem for night shipboard operations which adversely affects all ship-based aircraft. The Navy is working closely with the other Services and partners, the Joint Program Office (JPO) and Lockheed Martin to develop and test a solution that allows the aircraft to operate safely in all illumination and weather conditions at sea.

The Navy is working with all stakeholders to complete SDD in accordance with the program of record timeline while monitoring test point completion. Prior challenges with software stability have pressurized the schedule. Ultimately, the Navy requires the advertised 3F

capability to include full weapons and aircraft envelope so our warfighters can meet the current threat.

As one of three key component systems of the F-35C, timely delivery of the Autonomic Logistics Information System (ALIS) is extremely important. The Navy is working directly with the U.S. Marine Corps and the JPO to ensure ALIS will meet the Navy's IOC requirements by the end of SDD and adequately support Department of the Navy activities; specifically, overcoming bandwidth limitations unique to operations at sea. Additionally, squadrons at sea for extended periods of time must be able to receive ALIS software upgrades. This effort should ensure that newer versions of software are "backward compatible" with older versions of software to reduce mission impact. Navy sustainment experts continue to examine ALIS compatibility with legacy information systems and the ALIS future software technical roadmap. Although these are being closely tracked and will require continued efforts, they currently present minimal risk to the Navy's F-35C IOC. ALIS 3.0 is expected to field in early calendar year 2018, which is ahead of the expected F-35C IOC date.

Procurement

PB-17 increases F-35C procurement over the Future Years Defense Program (FYDP) by ten aircraft, and requests \$592 million in Research, Development, Test, and Evaluation, Navy (RDT&E) and \$1.3 billion in Aircraft Procurement, Navy (APN). The PB-17 procurement ramp optimizes the squadron transition timeline based on current force structure and future deployment schedules. The Navy is committed to procuring F-35Cs to achieve essential fifth-generation capability for "what it takes to win" across all deployed Carrier Air Wings.

As additional aircraft arrive to the Fleet, a commensurate expansion of training throughput for both maintainers and pilots is necessary, as well as the appropriate military construction to support operations and training.

Follow-on Modernization (FoM)

For the Carrier Air Wing of the future to pace a rapidly evolving threat, the F-35C FoM plan must remain on schedule. It is not enough to just evolve the significant capabilities of the F-35C, but equally important to ensure those capabilities are integrated and interoperable with existing ships and Carrier Air Wing aircraft within the Carrier Strike Group. Critical enablers for Naval Integrated Fire Control (NIFC) only exist in Block 4 and the Navy's ability to conduct NIFC in the future is the cornerstone of how the future Carrier Strike Group will fight. Weapons integration, radar improvements, electronic warfare capabilities, interoperability, and real-time information dissemination must also continue to progress in order to guarantee mission success in the future high-end threat environment. The Navy is working closely with the United States Air Force and United States Marine Corps to ensure the FoM Capability Development Document adequately addresses warfighter requirements.

Closing

The dynamic security environment requires the speed, endurance, flexibility and autonomous nature of the Navy's Carrier Strike Group. The nation needs the tremendous capabilities of the F-35C on its carrier flight decks. The aircraft's stealth characteristics, long-range combat identification and ability to penetrate threat envelopes while fusing multiple information sources into a coherent picture will transform the joint and coalition view of the battlefield. The F-35C's capability will provide decision superiority to the nation's warfighters

to ensure that if deterrence fails, the United States can conduct decisive combat operations to defeat any enemy.

Rear Admiral DeWolfe Miller, III
Director, Air Warfare (OPNAV N98)

Rear Adm. DeWolfe Miller hails from York, Pennsylvania, and graduated from the U.S. Naval Academy in 1981. He holds a Master of Science in National Resource Strategy from the National Defense University, is a national security management fellow of the Maxwell School of Citizenship and Public Affairs, Syracuse University and is a graduate of the Navy's Nuclear Power Program.

Miller's command tours include Strike Fighter Squadron (VFA) 34, USS Nashville (LPD 13), USS George H.W. Bush (CVN 77) and as a flag officer, Carrier Strike Group (CSG) 2 providing support to maritime security operations and combat operations for Operations Enduring Freedom and Iraqi Resolve.

Miller's operational tours began after earning his wings of gold in 1983 as a flight instructor with Training Squadron (VT) 19 in Meridian, Mississippi, followed by his first fleet assignment with Attack Squadron (VA) 56, flying the A-7E aboard USS Midway (CV 41) in Yokosuka, Japan. After transitioning to the FA-18 in 1986, subsequent fleet tours included Strike Fighter Squadron (VFA) 25 on USS Constellation (CV 64), department head tour with VFA-131 aboard USS Dwight D. Eisenhower (CVN 69) and executive officer of USS Carl Vinson (CVN 70).

Miller's shore tours include FA-18 test director at Air Test and Evaluation Squadron (VX) 5 in China Lake, California; special aviation programs analyst on the staff of the chief of naval operations (N80); executive officer of Strike Fighter Weapons School Atlantic; deputy director of naval operations at the Combined Air Operations Center during Operation Allied Force; special assistant for Research and Development, Science and Technology and Operational Testing in the Office of Legislative Affairs for the Secretary of Defense; Aircraft Carrier Requirements officer for Commander, Naval Air Forces; and flag officer tours as director, intelligence, surveillance, and reconnaissance capabilities division and assistant deputy chief of naval operations for warfare systems, both in the Office of Chief of Naval Operations.

His personal decorations include the Defense Superior Service Medal, Legion of Merit, Bronze Star, Meritorious Service Medal, Air Medal, Navy and Marine Corps Commendation Medal, Navy and Marine Corps Achievement Medal and various campaign, unit and service awards. He has accumulated more than 4,000 mishap-free flight hours and 877 carrier-arrested landings.

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PRESENTATION TO THE
HOUSE ARMED SERVICES COMMITTEE
TACTICAL AIR AND LAND FORCES SUBCOMMITTEE
UNITED STATES HOUSE OF REPRESENTATIVES

SUBJECT: How the F-35 is Meeting Current and Future Fifth Generation Fighter Capability

STATEMENT OF: Lieutenant General (s) Jerry D. Harris Jr., USAF
Deputy Chief of Staff for Strategic Plans and Requirements
Headquarters U.S. Air Force

FEBRUARY 16, 2017

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INTRODUCTION

Chairman Turner, Ranking Member Tsongas, and distinguished Members of the subcommittee, it is my distinct pleasure to be here with you this morning. Thank you for the opportunity to discuss how the F-35 Joint Strike Fighter is meeting current and future fifth generation fighter capability needs. The Air Force eagerly anticipates the fielding of the final System Development and Demonstration Block 3F aircraft. With the F-35A, the Air Force will be capable of striking and destroying a broad range of targets, day or night, in adverse weather conditions. The F-35A missions will include Air Interdiction, Offensive and Defensive Counter Air, Close Air Support, Strategic Attack, Suppression and Destruction of Enemy Air Defenses, Armed Reconnaissance and Combat Search and Rescue. The F-35 will complement other low-observable assets including the F-22, B-2, and B-21 as well as our legacy fourth generation fleet. The F-35 will provide the Air Force with a survivable, lethal, maintainable, and supportable low-observable fighter aircraft which will become the mainstay of our future Combat Air Force.

The F-35 will be the fighter of the future. Not just for the Air Force but also for our sister Services and eight partner nations. Designing and developing an aircraft capable of the missions I've mentioned for three different services and eight partner air forces is probably the most complex and challenging undertaking in Department of Defense history. The systems on board the aircraft are among the most advanced systems in the world. Fusing all of these systems into a coherent, integrated solution that presents enormous amounts of information to the pilot is no easy task. Although challenges with the program exist with cost, schedule and performance, these challenges are being diligently addressed by the F-35 Joint Program Office with close and continual coordination with sister Services and Partners. I'll discuss some of these challenges as

I address how the F-35A is meeting the Air Force's current and future fifth generation fighter capability needs.

THE OPERATOR'S PERSPECTIVE ON PROGRESS

The Air Force declared Initial Operational Capability in August, 2016 with twelve aircraft in a Block 3i configuration. We continue to deliver new F-35As to our operational unit at Hill Air Force Base with twenty aircraft in place today. That squadron deployed to Red Flag in January to train with our sister services and coalition partners. Other participants included the Royal Air Force, Royal Australian Air Force, United States Navy and United States Marine Corps. Missions included integration with F-16s, F-15s, F-18s, F-22s and a variety of command and control assets. The F-35 performance in Red Flag 17-1 was outstanding. Aircraft and crews integrated seamlessly with all other participants, delivered a dramatic increase in Air Force capability, and significantly enhanced the capabilities of the entire force of 80 aircraft taking part in the exercise. Our first operational squadron is scheduled for additional deployments this calendar year to include a Theater Security Package Deployment to Pacific Command.

Block 3i is an interim aircraft configuration sufficient for Initial Operational Capability. In the hands of Airmen, the F-35A has exceeded our expectations. Block 3i F-35As provide a lethal and survivable 5th Generation Fighter capability to our Combatant Commands that can detect, track and engage targets in contested environments. However, in order to meet the full spectrum of Joint warfighter requirements in future years, the Air Force will need the full warfighting capability that comes in Block 3F.

In September, we will start the stand-up of our second F-35A operational squadron. This squadron will also be at Hill Air Force Base and will be configured with Block 3F aircraft. Block 3F will expand the number and type of weapons carried, provide improved targeting and identification functionality, and enhanced datalinks resulting in improved communication and interoperability. By the end of 2018, we will have two combat coded F-35A squadrons available for world-wide deployment.

PERSPECTIVE ON COMPLETING SYSTEM DEVELOPMENT AND DEMONSTRATION

Concerning the completion of the System Development and Demonstration phase, although delivery of the final Block 3F configured aircraft is later than expected, the Air Force remains optimistic that remaining fixes to known deficiencies for all systems except the AIM-9X will be implemented within the Joint Program Office estimated timeline of October, 2017. The AIM-9X heat seeking missile capability will be delivered one month later in November, 2017. We understand there is risk of up to four additional months before a fully certified aircraft can be delivered. Any delay at this point will further delay our ability to enter into Initial Operational Test and Evaluation or IOT&E. This IOT&E period is where we will fully wring out the aircraft with our best test pilots employing the F-35 in complex scenarios against the most realistic threat simulations we can create. Although we would like to start this IOT&E phase as soon as possible, we do not want to rush the program to an arbitrary end that delivers an aircraft that isn't fully developed and tested.

Concerning the introduction of Block 3F software, the Air Force will have approximately 108 aircraft in either a Block 2B or 3i configuration that will eventually need to be retrofitted with

software and/or hardware upgrades. Approximately twenty-six of these aircraft will require a software-only upgrade. This process will take approximately three days per aircraft to load and thoroughly test the new software. Nineteen aircraft will require new signal processor cards in addition to the software modification. These new cards take minimal time to install and test so the average retrofit time remains approximately three days. Eighteen aircraft will require installation of a newer Helmet Mounted Display System in addition to the signal processor cards and software. The hardware installation will take approximately fifteen days to install and check out. The remaining forty-five aircraft will require significant hardware modifications in the form of a Tech Refresh 2 modification. This modification consists of twenty-six major components and takes approximately thirty days per aircraft to install and checkout. The Air Force is working with the Joint Program Office on a detailed retrofit plan to efficiently and smartly upgrade the existing fleet to the Block 3F configuration.

There are potential risks with any system of this complexity. Since the aircraft is still in development, we've focused on prioritizing noted deficiencies so the Joint Program Office understands which problem areas must be fixed, as well as those that may be resolved with a short-term solution until a more permanent solution can be found. We feel the Joint Program Office and Lockheed-Martin are doing everything in their power to solve remaining issues and produce the aircraft the Air Force needs.

In addition to ensuring the procurement of the promised Block 3F capabilities, the areas of greatest concern are Mission Data Files, modification of our IOT&E fleet and the Joint Simulated Environment. The Mission Data Files describe the sensed environment to the aircraft so that it can

determine how it should respond. While the Operational Flight Program of the aircraft will not change until the next software release, the Mission Data File is tailored to specific Areas of Responsibility and specific threat systems. These files will change as the threat changes. Currently, Mission Data File production capacity and rapid reprogramming ability is limited for emerging threats. Next, the Air Force fleet of Operational Test aircraft requires modification to the final Block 3F hardware configuration. These modifications are behind schedule with availability of the full fleet of twenty-three aircraft projected in mid-2018. The Air Force is working with the Joint Program Office to accelerate this schedule. Finally, the Joint Simulated Environment is the system where we'll train to employ this complex aircraft. The Joint Simulated Environment is almost as complex as the aircraft itself. It will use the actual Operational Flight Plan as well as the Mission Data Files just mentioned. It will provide a very realistic representation of what the aircraft can do against real-world threats and real-world targets. Unfortunately, the Joint Simulated Environment is also behind schedule with an earliest projected ready-to-use date of mid-2018 and a fully accredited simulator available around the start of 2019. Again, we're working with the Joint Program Office to do whatever we can to accelerate this schedule.

F-35A PROCUREMENT IN THE FUTURE

The F-35A acquisition schedule makes the F-35 a critical component of the Air Force long-term fighter force. Currently, the Air Force plans to procure an average of forty-eight F-35As annually over the Future Years Defense Program or FYDP for fiscal years 2018-2022. Accelerating the procurement rate prior to the development of Block 4 would add overall cost to the program. If we were to procure at higher than planned rates inside the FYDP, the Air Force

would have to retrofit aircraft already delivered to the fleet with Block 4 hardware and software modifications. Once Block 4 delivers near the end of the FYDP, we should examine the option of accelerating the F-35A program above the current procurement rate to meet the 5th Generation requirements necessary to balance the Air Force ability to fulfill national security objectives.

FOLLOW-ON MODERNIZATION CAPABILITY

The follow-on modernization, effort for the F-35A centers on the Block 4 upgrade currently in the early stages of planning. Block 4 will bring increased capability beginning in fiscal year 2021 and approximately every two years thereafter. Block 4 is geared toward meeting the estimated threat in the 2025 timeframe and beyond. Capability improvements will include integration of additional weapons and upgrades to the electronic warfare system, datalink systems, and radar. The Air Force is placing great importance on the hardware upgrade planned as Technical Refresh 3. Technical Refresh 3 will add an improved integrated core processor, an improved panoramic cockpit display, a more capable aircraft memory system as well as other classified hardware changes.

The Air Force is concerned over funding for Block 4. Congress marked the F-35A follow-on modernization in fiscal year 2016 by approximately sixty percent. Similar marks currently exist for fiscal year 2017. Both of these budgets were marked as “Early to Need” based on the lack of a Capability Development Document. The Capability Development Document is currently on schedule to meet the March Joint Requirements Oversight Council for approval. I can’t emphasize

enough how important it is that we fully fund Block 4. We are at a crucial stage where we must begin the developmental work to ensure we have these capabilities available to meet a 2025 need.

READINESS OF AUTONOMIC LOGISTICS INFORMATION SYSTEM

The Air Force approved the Joint Program Office's Autonomic Logistics Information System, or ALIS, Roadmap to meet System Development and Demonstration requirements. Since Initial Operational Capability declaration in August, 2016, the Air Force has demonstrated the capability of deploying with the current ALIS 2.0.1 software. Last summer, our Hill Air Force Base squadron conducted a practice deployment to Mountain Home Air Force Base where no prior F-35A support infrastructure existed. This, in addition to our recent Exercise Red Flag deployment in January, showed no major or minor issues with ALIS. The next scheduled release of ALIS 2.0.2 software is March, 2017. This release will deliver a capability to track life limited parts on both the engine and air vehicle. In addition, ALIS 3.0 will deliver in 2018 and will enhance our ability to manage and use ALIS.

The Air Force has been very disappointed with ALIS schedule delays and planned capabilities migrating out of ALIS 3.0, but are encouraged by the capabilities that each new version brings. We are confident that ALIS capabilities at the completion of System Development and Demonstration will provide the ability to meet readiness goals and deliver a system that will be able to grow and adjust with changing demands.

CONCLUSION

In conclusion, the United States Air Force remains confident the F-35A will provide the survivability, lethality, and maintainability the Combat Air Force needs to meet current and emerging world-wide threats. We remain optimistic the Joint Program Office will deliver a Block 3F aircraft with full warfighting capability in 2017 or early 2018. The Air Force will continue to work closely with our sister services and the Joint Program Office to ensure the right capabilities are delivered and any challenges are prioritized. Our initial experiences with our Block 3i aircraft give us confidence we are on the right path. As our Chief of Staff of the Air Force, General Goldfein, recently stated "Air and Space superiority are not American birthrights. They must be fought for and won." Finishing the F-35A System Development and Demonstration program of record and transitioning to Block 4 follow-on modernization are critical to ensuring the Air Force is ready to fly, fight, and win when called upon. I thank the committee for their support of the Armed Forces and our nation. Thank you for the invitation and for allowing me to speak with you today.

MAJOR GENERAL JERRY D. HARRIS JR.

Maj. Gen. Jerry Harris is Vice Commander, Air Combat Command, Langley Air Force Base, Virginia. He assists the Commander in organizing, training, equipping and maintaining combat-ready forces for rapid deployment and employment while ensuring strategic air defense forces are ready to meet the challenges of peacetime air sovereignty and wartime defense. The command operates more than 1,300 aircraft, 34 wings, 19 bases, and has more than 70 operating locations worldwide with 94,000 active-duty and civilian personnel. When mobilized, the Air National Guard and Air Force Reserve contribute more than 700 aircraft and 49,000 people to ACC. As the Combat Air Forces lead agent, ACC develops strategy, doctrine, concepts, tactics, and procedures for air- and space-power employment. The command provides conventional and information warfare forces to all unified commands to ensure air, space and information superiority for warfighters and national decision-makers. The command can also be called upon to assist national agencies with intelligence, surveillance and crisis response capabilities.

General Harris entered the Air Force in 1985 as a graduate of the ROTC program at Washington State University. He has served as a flight commander, operations officer, weapons officer, and inspector general. The general served on the staffs of two numbered Air Forces and one major command, all in operations. He has also served as the Combined Air and Space Operations Center Battle Director for operations Iraqi Freedom and Enduring Freedom. General Harris has commanded at squadron, group and wing levels. Prior to his current assignment, he was the Director of Programs, Office of the Deputy Chief of Staff for Strategic Plans and Programs, Headquarters U.S. Air Force, Washington, D.C.

General Harris is a command pilot with more than 3,100 flying hours in the F-16.

EDUCATION

1985 Bachelor of Science in Mechanical Engineering, Washington State University
 1992 Squadron Officer School, Maxwell AFB, Ala
 1997 Air Command and Staff College, Maxwell AFB, Ala.
 1997 Master of Science in Aeronautical Science Technology, Embry-Riddle Aeronautical University, Daytona Beach, Fla.
 1998 School of Advanced Airpower Studies, Maxwell AFB, Ala.
 1998 Master of Science in Airpower Art and Science, School of Advanced Airpower Studies, Maxwell AFB, Ala.
 1998 Armed Forces Staff College, Norfolk, Va.
 2001 Air War College, by correspondence
 2006 National Defense College, New Delhi, India
 2011 Capstone General and Flag Officer Course, National Defense University, Washington, D.C.

ASSIGNMENTS

1. February 1986 - January 1987, Student, undergraduate pilot training, Williams AFB, Ariz.
2. January 1987 - April 1987, Student, AT-38B lead-in fighter training, Holloman AFB, N.M.
3. April 1987 - December 1987, Student, F-16 B-Course, MacDill AFB, Fla.
4. December 1987 - July 1989, Chief, Current Operations Division; Squadron Assistant Programmer; Training Officer; and Mobility Officer, Nellis AFB, Nev.
5. August 1989 - January 1992, Chief of Weapons and Tactics and Air-To-Surface Weapons Officer, Moody AFB, Ga.
6. January 1992 - February 1992, Student, Squadron Officer School, Maxwell AFB, Ala.
7. February 1992 - March 1994, Chief of Mid-range Programming and Student, Fighter Weapons School, Luke AFB, Ariz.
8. March 1994 - June 1996, Weapons and Tactics Flight Commander; Chief of Wing Weapons; and

Chief of Squadron Weapons, Eielson AFB, Alaska
 9. July 1996 - July 1998, Student, School of Advanced Airpower Studies and Air Command and Staff College, Maxwell AFB, Ala.
 10. July 1998 - September 1998, Student, Armed Forces Staff College, Norfolk, Va.
 11. September 1998 - March 1999, NATO Joint Staff Officer, Long-range Plans, Plans and Policy, Headquarters, Southern Region Air Command, Naples, Italy
 12. March 1999 - August 2000, Chief of Strategy, Crisis Action Group, Headquarters Southern Region Air Command, Naples, Italy
 13. September 2000 - January 2001, Student, F-16 requalification, Luke AFB, Ariz.
 14. January 2001 - February 2003, Operations Officer and Chief of Standardization and Evaluation, 20th Operations Group; and assistant Director of Operations, 79th Fighter Squadron, Shaw AFB, S.C.
 15. March 2003 - February 2005, Commander, 79th Fighter Squadron, Shaw AFB S.C.
 16. March 2005 - July 2005, Staff Director and Inspector General, 20th Fighter Wing, Shaw AFB S.C.
 17. July 2005 - December 2005, Deputy Commander, 20th Operations Group, Shaw AFB S.C.
 18. January 2006 - January 2007, Student, National Defense College, New Delhi, India
 19. January 2007 - July 2008, Commander, 505th Training Group, Hurlburt Field, Fla.
 20. July 2008 - November 2008, Director of Air, Space and Information Operations, 13th Air Force, Hickam AFB, Hawaii
 21. November 2008 - September 2009, Commander, 8th Fighter Wing, Kunsan Air Base, South Korea
 22. September 2009 - September 2010, Assistant Director of Operations, Plans, Requirements and Programs, Headquarters Pacific Air Forces, Hickam AFB, Hawaii
 23. September 2010 - September 2012, Commander, 56th Fighter Wing, Luke AFB, Ariz.
 24. September 2012 - March 2014, Vice Commander, 5th Air Force, Yokota Air Base, Japan
 25. March 2014 - April 2015, Director of Programs, Office of the Deputy Chief of Staff for Strategic Plans and Programs, Headquarters U.S. Air Force, Washington, D.C.
 26. April 2015 - present, Vice Commander, Air Combat Command, Joint Base Langley-Eustis, Virginia

SUMMARY OF JOINT ASSIGNMENTS

September 1998 - August 2000, NATO Joint Staff Officer, Long-range Plans, Plans and Policy; and Chief of Strategy, Crisis Action Group, Headquarters Southern Region Air Command, Naples Italy, as a major

FLIGHT INFORMATION

Rating: command pilot
 Flight hours: more than 3,300
 Aircraft flown: F-16, T-37, T-38, Mig-29 and Mig-21

AWARDS AND DECORATIONS

Distinguished Service Medal
 Legion of Merit with two oak leaf clusters
 Defense Meritorious Service Medal
 Meritorious Service Medal with two oak leaf clusters
 Air Medal with three oak leaf clusters
 Aerial Achievement Medal
 Air Force Commendation Medal with two oak leaf clusters
 Joint Service Achievement Medal
 National Defense Service Medal with bronze star
 Southwest Asia Service Medal with three bronze stars
 Kuwait Liberation Medal (Kingdom of Saudi Arabia)
 Kuwait Liberation Medal (government of Kuwait)

EFFECTIVE DATES OF PROMOTION

Second Lieutenant May 11, 1985
 First Lieutenant Sept. 1, 1987
 Captain Sept. 1, 1989
 Major Sept. 1, 1995
 Lieutenant Colonel April 1, 2000
 Colonel Jan. 1, 2006
 Brigadier General Nov. 3, 2010
 Major General June 27, 2014

(Current as of May 2016)

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

FEBRUARY 16, 2017

QUESTIONS SUBMITTED BY MR. TURNER

Mr. TURNER. We have read a lot that SDD may not complete by the end of October of this year. Can you give this committee the ground truth as where we are with completing SDD? And why is your estimate to complete so much lower than what DOT&E has said?

General BOGDAN. The completion of System Development and Demonstration (SDD) will be event driven. The JPO/Industry team will continue SDD until the full Block 3F capability is delivered to the warfighter. There is no intention of truncating the program on any specific calendar date or at some pre-determined budget-level. There are two important milestones associated with the closeout of this phase of the program: Completion of SDD flight test and the delivery of the full Block 3F capability.

Completing SDD Flight Test: The original 2011 re-baselined Program of Record showed flight testing ending on 31 October 2017. The JPO has always believed there is 3 to 4 months of risk to this completion date, putting the end of SDD flight test in February 2018. However, the Department has directed the JPO to maintain the resources necessary to continue flight testing to May 2018 if necessary. The JPO's risk-adjusted date of 31 January 2018 is the result of a number of flight test delays experienced in the past 2 years including the 2014 F-35 engine fire and the Block 3i software stability issues which delayed Block 3F flight testing. We are confident flight testing will be completed in January 2018.

Delivering Full Block 3F Capability: The delivery of the full capability for all 3 variants falls within the original 2011 Acquisition Program Baseline dates with the exception of the B-model envelope expansion to 1.6 Mach.

Full Block 3F Capability Delivery

2011 Post Nunn-McCurdy APB Dates	Current Estimate
Objective: August 2017	F-35A: October 2017 (w/o AIM-9X) November 2017 (w/ AIM-9X) F-35B: November 2017 (1.3 Mach) May 2018 (1.6 Mach)
Threshold: February 2018	F-35C: January 2018 (1.3 Mach) February 2018 (1.6 Mach)

SDD Cost-to-Complete: The remaining SDD work is estimated to cost \$2.3 billion which includes an additional \$532 million above the current funded program. The additional funding is needed due to several factors. First, there were additional requirements added to the program during SDD (e.g., deployable ALIS, mandated program security changes, mandated aircraft cyber security changes) which were never paid for at the time they were executed. These new requirements totaled \$165 million. Secondly, DOD removed \$100 million from SDD funding in prior years to pay other higher priority bills and this money was never restored to the Program's baseline SDD budget. Finally, a shortfall of approximately \$267 million was caused by unforeseen events, such as the 2014 engine fire and the delay to Block 3F testing while the Program improved Block 3i software stability and fusion issues; both of these issues resulted in added schedule and cost to the completion of SDD. The \$265 million of "payback" along with the \$267 million due to unforeseen events resulted in a need for an additional \$532 million. This money as mentioned above will be sourced from inside the F-35 Program using management reserve, unearned fee, and the savings resulting from negotiating lower costs on various contracts. In addition, use of this internal funding will result in no impact to any other DOD programs or the Services/DOD's budget requirements. Additionally, as mentioned previously the Department has directed the JPO to maintain the resources necessary to continue SDD flight testing to May 2018. Should flight testing beyond February 2018 to May 2018 be necessary the JPO will hold \$100 million of Follow-on-Mod-

ernization (FOM) funding in fiscal year (FY) 2018 to pay for this added flight testing.

In response to DOT&E's assessment and recommendations on SDD completion and cost, the JPO's estimate incorporates schedule and cost savings/avoidance brought about by a disciplined process to identify No-Longer-Required (NLR) test points based on previous results and implementation of an improved, more rapid software deficiency resolution process. The F-35 program will continue to implement these disciplined processes in close coordination with the Operational Test, Developmental Test and operational user community and is committed to correcting all deficiencies that the Services and Partners deem necessary to fix. Based on progress to date, we are confident both SDD Flight Test Completion and Delivering Full Block 3F Capability milestones will meet the above schedule.

As a final note on the SDD budget, it is important to look back to the 2011 Rebaselined Program and compare today's cost estimate to complete SDD with the cost controls put in place after the Nunn-McCurdy Breach. The following table makes this comparison.

SDD Cost Baseline

2011 Post Nunn-McCurdy 2011	Current Estimate
Objective: \$13.9 B (50% probability) Threshold: \$15.1 B	\$13.9 B delta = \$267 M (discoveries) Total = \$14.2 B

As the chart indicates, the Program has remained within \$267 million (2.1%) of the 2011 Objective Budget Estimate and well below the Threshold Budget Estimate, indicating that the fiscal discipline and cost control measures executed by the Department have been effective.

Mr. TURNER. What is the JPO and industry doing to adjust to a potential increase in production demand, a ramp up if you will?

General BOGDAN. The JPO and Industry have been anticipating and preparing for the ramp to full rate production since re-baselining the program in 2011. Industry capacity and infrastructure to support peak production are assessed annually through joint Production Readiness Reviews (PRRs), as well as industry-led capacity deep dives. The next increment of PRRs is set to be conducted from 2nd Quarter 2017 through 1st Quarter 2018. Lockheed Martin's assembly operations, as well as 27 key suppliers, will be assessed.

F-35 final assembly facilities and their suppliers have for the most part established an infrastructure and manufacturing footprint that will support full rate production. The focus now and in the immediate future is adding the tools and additional skilled workforce necessary to fully leverage the infrastructure that is in place. Key enablers that we are executing to support the ramp to full rate production include:

- Stabilizing the F-35's design: This supports more efficient production, with less disruptions from product definition and manufacturing changes;
- Issuing timely contract awards: This enables assembly and fabrication operations to begin with adequate lead times and focus on timely deliveries;
- Improving Tooling and Manufacturing Technologies: This enables improved quality, reduced span times, increased production efficiency, and better schedule adherence; and
- Maximizing Dual or Alternate Sourcing: This reduces single point failures in the supply chain, as well as provides competition that can be leveraged for improved affordability.

Rate readiness will continue to be evaluated to validate capacity and identify and mitigate risks in transitioning to full rate production. The JPO is confident that the Government-Industry team can execute the current production ramp up plan.

Mr. TURNER. The F-35's Autonomic Logistics Information System or ALIS has been challenged and in some cases lacking. General Bogdan, when do you expect to deliver the full capability of ALIS 2.0.2 and what steps has the program taken to improve the delivery performance?

General BOGDAN. The F-35 JPO agrees that the Autonomic Logistics Information System or ALIS has been a challenge. The System is improving and providing good capability to the field; however, there is still more work to be done. The System is a "first of its kind" for maintenance and logistics management within DOD.

Improving Performance: Recognizing we needed to do a better job with ALIS development, the JPO/Industry team took these measures:

- First, we created an ALIS Operational Representative Environment (ORE) at Edwards Air Force Base in California. The ALIS ORE functions as the test platform for ALIS that allows us to test ALIS in a more operationally relevant environment.
- Second, industry has added additional software expertise to its team.
- Finally, from an operational perspective, as ALIS supported Development Test and Operational Test events ashore and afloat, we took the lessons learned from the deployability demonstrations and incorporated them into an ALIS Deployment Guide

Expected Delivery: The next version of ALIS, version 2.0.2, is complete. This version of ALIS combines the management of F135 engine maintenance within ALIS and tracks all the life-limited parts on each and every F-35 aircraft. Our original estimate was that ALIS 2.0.2 would be fielded in December 2016. The software was installed at Nellis Air Force Base in Nevada on 23–26 March and is performing well. The deployment plan for all sites has been established and we are executing to that plan. All operational sites will transition to ALIS 2.0.2 by the end of October 2017.

Mr. TURNER. Last year when you appeared before this committee, the F-35 development program was experiencing challenges with the software's stability. Can you give us an update on this and let us know if this issue persists?

General BOGDAN. Let me begin by first characterizing the software stability challenges and what we were seeing a year ago. At the time, we had both Block 3i and Block 3F mission software in flight test and we were experiencing instability in the sensors—particularly the radar—leading it to shut off and “reboot” in flight. This was occurring about once every 4 hours of flying, far below where we wanted it to be—once every 8 to 10 hours.

We did two things to work through this:

- First, I suspended all Block 3F mission systems flight testing so we could apply all our energy and resources on Block 3i, the software version we needed to support the Air Force's Initial Operating Capability, and the software that formed the foundation of Block 3F.
- Second, we assembled a team of Government and Industry experts—A Software Red Team—to dig into this and identify the root cause and make recommendations to improve our software development and test process.

Today the Block 2B and 3i mission software is exceeding initial estimates in terms of stability. The Block 2B software experiences a software stability event once every 29 flight hours and Block 3i experiences a software stability event once every 25 flight hours. These are the software versions that our U.S. Marines and Airmen are flying with in their operational combat-coded F-35s. These stability measures are considered excellent when compared to our original stability starting points and when compared to legacy aircraft that have far less complex software systems.

The F-35's Block 3F software is more complex than Block 3i so we anticipated having to work through a learning curve—test, fix, and verify. We initially were seeing a software stability event once every 5 flight hours and now we're seeing that improve. The current Block 3F software that is in flight test is well above the 10 hour goal showing us a stability event once every 22 hours. While this is encouraging, we're not ready to claim victory yet. We need to do a lot more testing and get a lot more flight hours with this software before we say with certainty that it's as stable as Blocks 2B and 3i.

Mr. TURNER. Another area you discussed with us last year is the technical challenges with the F-35's ejection seat system. Please share with the committee what progress the program has made in resolving this and what if anything remains to be done?

General BOGDAN. The F-35 ejection seat/escape system is not only the safest we have today but provides protection for the widest range of pilots—from 103 pounds to 245 pounds—of any ejection system ever built. During the summer of 2015, the F-35 Government and Industry team became aware of an issue with the F-35 ejection seat/escape system that led to, in August 2015, the U.S. Services and International Partners restricting F-35 pilots weighing less than 136 pounds from operating the F-35 after safe escape tests indicated the potential for increased risk of injury to this pilot population.

Expert teams from the U.S. Services, Joint Program Office, and industry developed and tested three technical solutions that when in place will reduce the risk of neck injury to all pilots and will eliminate the restriction to any pilot population. These solutions include:

- A head support panel between the rear parachute risers that prevents neck over-extension; ? A pilot-selectable weight switch to reduce opening parachute loads; and
- A lighter F-35 helmet.

Test data indicates that these fixes have made all pilots safer if they have to eject from an F-35 and have reduced neck loads sufficiently to allow the smallest lightest pilots (103 lbs.) to fly the F-35. All testing has been completed and the F-35 Joint Program Office (JPO) System Safety team has provided its recommendation to the U.S. Services to remove pilot restrictions. The JPO expects to begin retrofit of fielded aircraft in April, pending final Service approval. The production cut in of these fixes is our Lot 10 aircraft.

Mr. TURNER. What is the optimal ramp rate for F-35 procurement for the Marine Corps?

General DAVIS. An optimal F-35B ramp for Marine Aviation, across the FYDP would be 20, 23, 23, 23, 30 and up to 37 in 2023, increasing to full rate production outside the FYDP until we complete our program of record. This gets us out of legacy aircraft and into new aircraft faster, saves money in procurement spending, avoids the increasing O&S costs of legacy platforms, and eliminates redundancies by modernizing from the current three legacy aircraft into the Joint Strike Fighter.

Mr. TURNER. How could F-35 help with strike/fighter readiness?

General DAVIS. The Marine Corps has a very different readiness model when compared to the other services. We are small in size, but are required to maintain a constant state of high readiness. As the "Nation's Force in Readiness," the answer to our tactical aircraft readiness challenges lies in the recapitalization of our legacy fleet, a process currently flowed out over the next 14 years, completing in 2030. The average age of any Harrier or Hornet in the Marine Corps is 22 years. The oldest Harrier in the inventory is 28 years old. The oldest C and D Hornets in the inventory are pushing 30 years, built just after Apple rolled out the first personal computer. These aircraft will be well into their 40s at the end of the transition. While these aircraft have met the call of duty and performed brilliantly in battle, maintaining aging legacy platforms is a challenge that costs more over time, especially with today's high operational tempo. Transitioning the fleet from legacy into F-35 as fast as prudently possible is the only way to ensure tactical readiness for future demands.

Mr. TURNER. How confident are you in F-35's capability to deploy?

General DAVIS. I am extremely confident in the capability of this aircraft to deploy and perform while deployed, as demonstrated by VMFA-121's deployment to PACOM in January 2017. The F-35B has proven itself ready to deploy through operational and developmental testing, participating in numerous large scale exercises, and conducting fleet operations. These efforts rigorously tested the ability of F-35 to move from a main base to an expeditionary site and then sustain simulated full spectrum combat operations. Whether aboard ship (OT-1, DT-3), or while conducting operations from austere environments such as the Strategic Expeditionary Landing Field in 29 Palms, Ca (Exercise Agile Lightning), F-35 met the operational mark. The aircraft performed exceptionally well during high end, large scale exercises; to include achieving never before seen results in the demanding scenarios of our weapons school (Weapons and Tactics Instructor Course) and the United State Air Force sponsored Red Flag Exercise. The aircraft is ready to rapidly deploy anywhere in the world; in the last 7 months it has flown across both the Pacific and Atlantic Oceans. Finally, we know it is ready to deploy because we've already done it. VMFA-121 just completed their squadron's permanent change of station (PCS) from MCAS Yuma, Az to Iwakuni, Japan and they are now firmly established overseas conducting operations.

Mr. TURNER. What kind of feedback have you received from your F-35 pilots in regards to performance?

General DAVIS. They love the aircraft. Our conversion pilots tell us they are more lethal and more survivable and wouldn't go back. Our newest generation of pilots is performing at levels previously occupied solely by legacy instructor pilots. The future is very bright. We are getting feedback from our pilots of unprecedented performance at our premier weapons school and during joint exercises. The confidence our pilots have in the aircraft is unprecedented and is well founded in the demonstrated leap forward in effectiveness and efficiency of the F-35B.

Mr. TURNER. Do you believe the amphibious fleet is ready to host the F-35?

General DAVIS. Absolutely. The LHA/LHD modernization schedule is on-track with the Wasp and Essex on timeline to make their upcoming MEU sail dates with F-35B aboard ship. The level of effort the USN has put forth to ensuring their ships and personnel are prepared, trained, and equipped to support F-35 operations has been great. F-35 conducted very successful test events at sea, to include operating

12 F-35Bs aboard the USS America during DT-3. Feedback from both OT-1 aboard the USS Wasp and DT-3 aboard the USS America has been very positive with F-35 meeting or exceeding every major milestone. The Navy and Marine Corps team has come together in two large format wargames to prepare for the upcoming deployment: the Ship Sustainment Working Group and the First Deployment Initiative. These two efforts addressed everything from what equipment we are going to bring aboard ship, to how we are going to conduct operations, to how we are going to sustain the aircraft while deployed. The result of all of this effort and preparation is going to be a more lethal, more ready, more prepared Navy/Marine Corps team when the ships sail next year with F-35 aboard.

Mr. TURNER. The Navy has always said that their requirement is to have a combination or mix of 4th gen and 5th gen aircraft. Based on the current assessment that the Navy is doing in regards to the SECDEF directive, will the Navy's requirement for F-35C variants remain at 260 aircraft?

Admiral MILLER. The Department of the Navy requires 340 F-35C aircraft. Based on detailed campaign analysis, the Navy plans to field a 50/50 mix of 4th and 5th generation Strike Fighters represented by the F/A-18E/F and the F-35C. This provides our Carrier Strike Groups the capability and capacity to meet any threat. Each of our nine Carrier Air Wings (CVWs) has four Strike Fighter Squadrons. Two of each of these four squadrons will be F-35C squadrons. There will be a total requirement of 18 F-35C squadrons. The remaining aircraft inventory represents training assets, aircraft out of reporting due to deep maintenance, modifications, and attrition. If the force requirement grows, this requirement would increase. The Navy and Marine Corps current TACAIR Integration Agreement (TAI) requires the Navy to field 14 F-35C squadrons and the USMC to field four squadrons. This represents a mix of 273/67 aircraft.

Mr. TURNER. We have been told about high-end warfare and near-peer competitors. What do you envision as the primary role of the F-35C in the air wing of the future, and how will it create an effective advantage over the most advanced threats you anticipate the Navy will face?

Admiral MILLER. The F-35C will form the backbone of the Carrier Air Wing of the future. The F-35C complements the Navy's tactical fighter fleet and through continuous improvements in both fourth and fifth generation aircraft, ensures the Carrier Strike Group (CSG) is capable of projecting U.S. power and deterring potential adversaries. The F-35C brings fifth generation capability to the Carrier Air Wing. The F-35C's stealth characteristics, long-range combat identification and ability to penetrate threat envelopes while fusing multiple information sources into a coherent picture will transform the CSG decision superiority. By combining the correct mix of fourth and fifth generation strike fighter aircraft, the Navy will have the capability and capacity to accomplish the full spectrum of mission requirements including immediate response to high-end threats.

Mr. TURNER. The F-35 program has seen its share of cost and schedule growth over the last two decades. Given the Navy's roadmap to IOC and planned first deployment, how confident are you in the Navy's plan and current status of integrating the F-35 into the fleet and deploying it with full warfighting capability?

Admiral MILLER. The United States Navy is very confident with its plan to integrate F-35C into the Carrier Air Wing and deploy as scheduled in 2021 in the 3F software configuration. The 3F software configuration will provide the full warfighting capability against the current threat. F-35C integration efforts are well underway. The Navy has captured and applied lessons learned, from both an operational and maintenance perspective, following three Developmental Test (DT) events on active Aircraft Carriers at sea. The Navy is also leveraging lessons learned from USMC F-35B Air-Ship-Integration (ASI) efforts.

Mr. TURNER. Recently, there was a significant developmental test conducted flying the F-35C onboard a carrier. We heard it was a success. Obviously, this testing is exclusive to the Navy. Can you describe the Navy unique requirements that must be met to integrate the F-35C onto a carrier?

Admiral MILLER. The Navy has three unique requirements that must be met in order to integrate the F-35C into the Carrier Air Wing (CVW) and Carrier Strike Group (CSG). These requirements include:

- (1) Completion of a Carrier Suitability (CS) assessment during System Development and Demonstration (SDD).
- (2) Refinement of the F-35C's Global Support Solution (GSS) to ensure effective and efficient logistics and sustainment at sea.
- (3) Demonstration that the F-35C is tactically integrated and interoperable with all Carrier Strike Group assets and required networks.

Amplification of each of these requirements is provided below:

(1) F-35C Carrier Suitability assessment is planned during the afloat phase of Initial Operational Test and Evaluation (IOT&E) in 2018. This assessment examines all phases of flight operations and maintenance activities. The Navy plans to use this assessment to identify any challenges that must be overcome prior to the first planned deployment in 2021.

(2) The GSS represents an entirely new approach to supply and aircraft sustainment at sea (compared to legacy Navy aircraft). GSS is based on a complex system that shares resources between all logistical support stakeholders. The Navy has a dedicated team of logistics and sustainment professionals working directly with the Joint Program Office to ensure the GSS is able to meet all Navy requirements.

(3) The F-35C must demonstrate it is tactically integrated and interoperable with all Carrier Strike Group assets and required networks. Although not fully addressed here, this includes collaborative mission planning, in-flight mission specific requirements and post mission information dissemination. The Navy continues to develop the infrastructure and "Command and Control" (C2) required to meet these battlespace awareness and mission execution requirements the F-35C will provide.

Mr. TURNER. We've heard a lot about the "Delta Flight Path," or Magic Carpet, precision landing mode. Can you explain the results that were seen during the recent carrier testing and how you think this will effect training, performance and safety in the future?

Admiral MILLER. Delta Flight Path (DFP) is the Precision Landing Mode utilized by the F-35C for carrier arrested landings. The software is nearly identical to the MAGIC CARPET software recently introduced to the F/A-18E/F fleet. DFP was tested on all three F-35C Developmental Test evolutions and used by VFA-101 for the first fleet Carrier Qualification (CQ) at-sea period. A total of 12 pilots from VFA-101 completed their initial daylight CQ. These events included 154 approaches and resulted in a 100 percent boarding rate, of which, more than 80 percent were recovered using the targeted "3" wire. No recoveries were made using the "1" wire—the least favorable landing wire. These statistics are truly remarkable. DFP reduces pilot workload and minimizes aircraft deviations from a targeted flight path. Based on the current data set, DFP contributed significantly to the safe recovery aboard the aircraft carrier during each of these events. The Navy will continue to track DFP events in order to assess future training requirements.

Mr. TURNER. The Senate Armed Services Committee and others have called for the Air Force to ramp up F-35A procurement faster and transition into a new fighter program sooner. Does the Air Force have any program or studies in place to develop a follow-on to the F-35A, or some type of air-to-ground specialist akin to the F-35A/F-16/F-15E?

General HARRIS. The Air Force does not currently have a program or study in place to develop a follow-on to the F-35A or any legacy air-to-ground aircraft. Early investigation is being made into advanced counter-air and electronic attack concepts. However, these investigations are not focused on air-to-ground aircraft.

Mr. TURNER. Do you anticipate any change to the Air Force requirement for 1,763 F-35s?

General HARRIS. The current F-35 program of record remains 1,763 aircraft.

Mr. TURNER. Given that we must be prepared to face a "near-peer" adversary, the likelihood of such a conflict is low. Is the F-35 still necessary against lower threat countries such as Syria or Iran?

General HARRIS. The F-35 is still necessary against lower threat countries such as Syria and Iran. Although these countries do not develop and field organic advanced threat systems, the USAF will face high threat systems exported by Russia and China. Iran already has the S-300 surface-to-air missile (SAM) system in place with Russian assistance. Several media reports also state that negotiations for the S-400 SAM system have already taken place. The view the USAF takes is that although the likelihood of facing a near-peer adversary in conflict is low, the likelihood of facing their exported advanced SAMs systems is very high. We must be prepared to meet and defeat or mitigate these advanced systems.

Mr. TURNER. The Air Force fiscal year 2017 budget request projected 44 F-35s for fiscal year 2018. Do you believe the Air Force will seek a higher F-35 procurement rate for fiscal year 2018?

General HARRIS. The Air Force will assess its planned buy for Fiscal Year 2018 (FY18) once it incorporates new fiscal guidance into its updated FY18 budget submission.

QUESTIONS SUBMITTED BY MR. LOBIONDO

Mr. LOBIONDO. As you know, earlier this month the White House announced a contract for 90 F-35 jets from Lockheed Martin Corp. valued at as much as \$8.2 billion. Given the desire to activate more Guard and Reserve troops in military missions to build readiness and given that the Armed Services are losing pilots with experience to civilian jobs.

In future F-35 basing decisions, have you considered looking to National Guard or Reserve bases sooner than originally planned or more often, where pilot retention is much more stable?

For example, has a follow up to the recent Ops 5 and Ops 6 decision for the Air Force's F-35A been considered?

General HARRIS. Yes, strategic basing decisions that follow Ops 5-7 are currently under consideration. As you know, the fifth and sixth F-35 operational locations are Air National Guard units and the seventh is an Air Force Reserve Command location. As it plays an integral role in our Total Force, we will continue to expeditiously bed down F-35s at Air Reserve Component bases. We anticipate starting the next round of F-35 basing this year, with accelerating the next ARC selection under consideration.

QUESTIONS SUBMITTED BY MR. LANGEVIN

Mr. LANGEVIN. I come from the Emerging Threats and Capabilities Subcommittee as Ranking Member, where cybersecurity is one of our highest priorities. Many have been critical of cybersecurity inadequacies within the F-35 program. Is intrusion testing being conducted on software that is currently in development?

General BOGDAN. Yes. Cybersecurity elements are embedded into the F-35's software modules including: the aircraft's Operational Flight Program (OFP), Mission Data Files (MDFs), Off board Mission Systems (OMS) and the Autonomic Logistics Information System (ALIS). Vulnerability and penetration testing is conducted throughout the software development process, and the U.S. Services perform independent audits of fielded software. The F-35 adheres to the DISA, U.S. Navy, U.S. Marine Corps, and U.S. Air Force cybersecurity policies/testing that lead to the granting of Authority to Operate (ATO) and Authority to Connect (ATC) for the F-35 Air System.

To date, the Joint Strike Fighter Operational Test Team (JOTT) has led 15 cyber testing efforts on the F-35 system using 10 different cyber testing teams from the U.S. Air Force, U.S. Navy, U.S. Marine Corps, and Lockheed Martin. These testing efforts include Cooperative Vulnerability Penetration Assessments (Blue teams), Adversarial Assessments (Red Teams), air vehicle testing and Blue team inspections ("Blue Hunts") for signs of illicit activity or software that could become active later.

Extensive testing has been done on the potential entry pathways into ALIS. Each major ALIS node gets re-tested with every major software release. Testing on the air vehicle began in 2016 and will expand in the next year. Blue and Red teams will also assess the U.S. Reprogramming Lab and training systems.

Vulnerabilities and areas where security can be improved are reported to the F-35 Joint Program Office in the form of Deficiency Reports, to be addressed in either immediate policy changes or future updates of software.

Mr. LANGEVIN. Can you compare the F-35's abilities compared to that of the next generation fighter jets coming out of China and Russia? Where do we excel, and additionally, what comparative challenges do we still face and must overcome?

General BOGDAN. The F-35's unique attributes of stealth and integrated systems afford an advantage over near peer adversaries' capabilities. The United States has the advantage of many years of experience developing and maintaining low observable platforms which has resulted in the advances you see in the F-35. Additionally, the F-35's sensor suite and information fusion are unmatched in providing and sharing battlefield awareness. Also, the F135 engine for the F-35 is more reliable and maintainable and has a reduced signature level than 4th generation aircraft engines. These advantages are brought to bear in advanced 5th generation tactics where the United States is the world leader. The F-35's Follow-on Modernization Program will ensure the F-35 maintains its advantage over a rapidly evolving threat of future.

Mr. LANGEVIN. Can you compare the F-35's abilities compared to that of the next generation fighter jets coming out of China and Russia? Where do we excel, and additionally, what comparative challenges do we still face and must overcome?

General DAVIS. The F-35 is without a doubt the most advanced, mass produced fighter aircraft in the world today. However, advanced aircraft and corresponding capabilities produced by competitors shows our advantage is shrinking. Other coun-

tries are aggressively developing low observable aircraft, advanced radars and IR sensors, along with highly capable air to air and air to ground weapons to compete with U.S. technology. While we currently enjoy a margin of advantage in building advanced avionics and stealth, these advantages won't last forever. It is imperative that we continue to invest in advancements in capability through follow-on-modernization (FOM) in order to maintain our tactical advantage over non-U.S. 5th generation platforms and provide the access the MAGTF requires to meet its mission. The Senate Defense Appropriations mark cut almost \$45M from Marine Corps JSF FOM. This could delay FOM by a year, which I think is a dangerous decision. My goal is to maintain a lead in this technology race to ensure our Marines get the aviation support they need in any and all fights.

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Admiral MILLER. The F-35C's unique attributes of stealth and advanced integrated systems are a tactical advantage over near peer adversaries now and into the future. Planned Follow-on Modernization is required to ensure the F-35C will continue to pace a rapidly evolving threat. Its ability to collect and disseminate information for the Carrier Strike Group (CSG) assets, in real-time battle space, shifts the focus from kinematics to information dominance and greatly enhances the CSG's awareness, lethality and survivability in a high-end conflict.

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QUESTIONS SUBMITTED BY MR. BACON

Mr. BACON. The demand for traditional ISR by the Combatant Commanders continues to vastly exceed Service capacity to source. In many situations, "fast air" fighter aircraft are the only eyes and ears over the battlespace capable of observing the enemy and sharing critical information with the joint force. The F-35 is

equipped with one of the most capable sensors suites ever developed; warfighter need and fiscal prudence requires that DOD smartly leverage the ability of our 5th gen aircraft to function as critical sensors over the battlefield. This capability is also important to many of our international partners, notably the U.K. Can you tell us what work has been accomplished to date to fully integrate the information collected by each F-35 sensor into our joint intelligence architecture? When will we have to ability to record and share what the F-35's active and passive sensors collect?

General BOGDAN. In the F-35's current Block 3F configuration, there is no capability to record sensor data because there was no original requirement to do so. However, this is a future requirement that will be addressed in the F-35's Follow-on Modernization Block 4 Program. In Block 4, the Program has a requirement to record and bring back sensor information for off board processing. The primary requirement for this capability is to fill the gaps or shortfalls of information or intelligence that is used to program Mission Data Files (MDF). The larger U.S. and Partner Military Intelligence communities (IC) are assessing the usefulness of the quantity and quality of the sensor data that an F-35 can provide. The F-35 Joint Program Office meets regularly with this community to assess IC requirements for access to this information and its ultimate processing and dissemination. Additionally, the U.S. Services and some Partners are developing their respective requirements (manpower and infrastructure) for the use of this data.

Mr. BACON. Success in a contested environment will depend on our ability to dominate the electro-magnetic spectrum. How has the AN/ASQ-239 electronic warfare suite performed in testing and live fly against high-end threats? What improvements are required to ensure the F-35 can dominate in a contested environment? What additional enhancements are required at the U.S. Reprogramming Facility (USRF) to ensure our pilots have the most up to date mission data?

General BOGDAN. The AN/ASQ-239 Electronic Warfare (EW) system has performed well in testing. The detection range, Advanced Emitter Location (AEL), Enhanced Geolocation (EGL), threat Identification (ID) performance and system response time all meet or exceed performance specification against the F-35 Block 3 advanced threats. Threats are continuously evolving and the current AN/ASQ-239 will face challenges against future advanced threats. Future planned improvements to stay ahead of the evolving threats include expanded Radio Frequency coverage, expanded Electronic Attack modes, and improved processing algorithms for advanced and emerging threats. Improved Mission Data File (MDF) development and testing capabilities are also important to the successful performance of the AN/ASQ-239. It is imperative that the United States Reprogramming Laboratory (USRL) be able to test and verify future MDF performance against the advanced threats. The F-35 Enterprise has plans to upgrade and improve the Reprogramming Labs to ensure we have the most up-to-date mission data. Examples of these future upgrades include a new, more robust Combat Electromagnetic Environment Simulator (CEESIM) and additional closed-loop threat simulation capability as well as improved tools to enable more rapid and efficient MDF creation.

Mr. BACON. The demand for traditional ISR by the Combatant Commanders continues to vastly exceed Service capacity to source. In many situations, "fast air" fighter aircraft are the only eyes and ears over the battlespace capable of observing the enemy and sharing critical information with the joint force. The F-35 is equipped with one of the most capable sensors suites ever developed; warfighter need and fiscal prudence requires that DOD smartly leverage the ability of our 5th gen aircraft to function as critical sensors over the battlefield. This capability is also important to many of our international partners, notably the U.K. Can you tell us what work has been accomplished to date to fully integrate the information collected by each F-35 sensor into our joint intelligence architecture? When will we have to ability to record and share what the F-35's active and passive sensors collect?

General HARRIS. The F-35's sensor fusion solution and data sharing capabilities are focused on providing the interoperability required by the warfighter in support of the execution of the mission at the tactical level. The program is currently planning increased capability in these areas as part of Follow-on Modernization, to include Tactical Data Recording capability, which will allow the warfighter to record and use this data for "next day" missions. While there is no current capability or approved operational requirement to contribute to the Process, Exploit, Dissemination (PED) architecture, the Services continue to investigate future opportunities to include this capability in future F-35 upgrades.

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QUESTIONS SUBMITTED BY MR. LAMBORN

Mr. LAMBORN. Since initial contract award of the F-35 ejection seat, what is the total cumulative number of ejection seat tests to date that have been accomplished to qualify the Martin Baker ejection seat for the F-35?

General BOGDAN. The F-35 Program has completed a total of 124 ejection seat tests (with an ejection seat actuated from a test sled or test aircraft). These tests began in 2005 and completed in 2016. The tests included:

- 8 tests in 2005 performed as proof of concept testing
- 16 tests in 2006 developing and certifying the dash 1 (-1) seat version for use in the first F-35 aircraft
- 31 tests between 2007 and 2009 developing and certifying the dash 2 (-2) seat version for use in the Systems Development and Demonstration (SDD) aircraft
- 32 tests between 2009 and 2010 developing and certifying the dash 4 (-4) seat version for use in the Low Rate Initial Production (LRIP) aircraft
- 15 tests between 2012 and 2015 developing and certifying the Generation III Helmet-Mounted Display for use in SDD and LRIP aircraft
- 22 tests between Nov 2015 and Sep 2016 to qualify the dash 6 (-6) seat version for use in LRIP aircraft

Mr. LAMBORN. Since initial contract award of the F-35 ejection seat, how many design changes have there been to the Martin Baker seat?

General BOGDAN. There have been three design configuration changes to the F-35 ejection seat cleared for flight since the original configuration for a total of four versions. Each configuration is designated with a dash number, -1, -2, -4 and -6. The -1 seat was the first design cleared and supported the first F-35 aircraft which is designated AA-1. The -1 seat was similar to legacy seats that came before the F-35. The -2 seat introduced an airbag system to support the pilot's head during the initial stages of the ejection (when the pilot is in the seat). The -4 seat refined the airbag system to incorporate lobes beside the head to keep the head centered during the initial stages of ejection. The -6 seat effort was to redesign and test a new sequencer due to Diminishing Manufacturing Sources. During that process, performance deficiencies were discovered and prompted additional design efforts that led us to introduce a head support panel (HSP) between the rear risers of the parachute to support the head of the pilot after separation from the seat and a pilot selectable switch (aka the "light/heavy pilot weight switch") to control parachute opening loads.

Mr. LAMBORN. Lt Gen Bogdan indicated that the Air Force incurred no additional costs with recent modifications and testing of the Martin Baker seat to qualify for lower weight pilots. Has the program ever incurred any costs due to design changes or testing of the Martin Baker seat since contract award?

General BOGDAN. Yes. The ejection seat system has undergone incremental development and the Program has borne those costs. There have been three design configuration changes to the F-35 ejection seat cleared for flight since the original configuration with the latest version being designated as the "-6" version. The -6 seat effort was to redesign and test a new sequencer due to Diminishing Manufacturing Sources. During that process, performance deficiencies were discovered and prompted additional design efforts that led us to introduce a head support panel (HSP) be-

tween the rear risers of the parachute to support the head of the pilot after separation from the seat and a pilot selectable switch (aka the “light/heavy pilot weight switch”) to control parachute opening loads. The costs to design and test modifications due to the performance deficiencies were incurred by the Industry team (Lockheed Martin, BAE Systems and Martin Baker).

